JANUARY 1955 — SIXTY FIRST YEAR

MACHINERY

Photographed at Verson Allsteel Press Co. Chicago

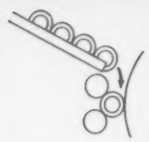
ARMSTRONG
System of TOOL HOLDERS

Here, a No. T-4-R ARMSTRONG Carbide Tool Holder with a ½" sq. carbide-tipped tool bit in a 24" geared head lathe is machining high-carbon, high-chrome steel draw rings. This ARMSTRONG Tool Holder, using inexpensive tool bits, is doing an outstanding job of cutting cutting-costs. Are you taking full advantage of the cost cutting ARMSTRONG Tool Holder system?

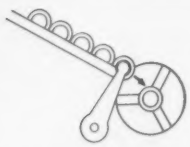
TRADE MARK

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* CHICAGO, U.S.A.

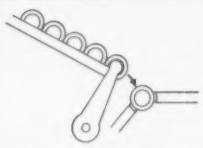
TRADE MARK ARMSTRONG BROS. TOOL



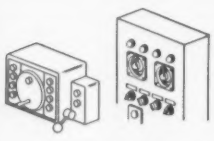
AUTOMATIC LOADING AND LOCATING IN CENTERLESS ROLLS



AUTOMATIC CHUCKING



AUTOMATIC LOADING AND LOCATING, CENTRI-MATIC



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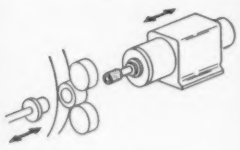
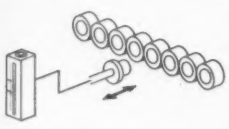
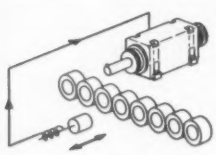


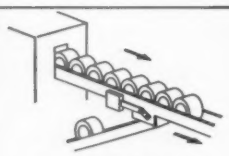
AUTOMATIC SIZING



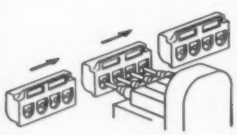
AUTOMATIC GAGING



FEED-BACK

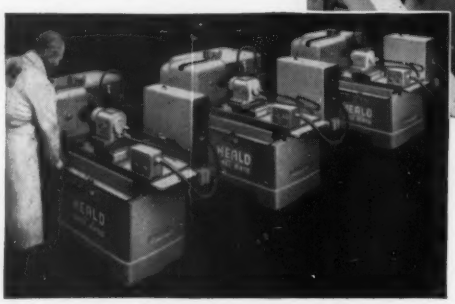


AUTOMATIC HANDLING AND SORTING



AUTOMATIC TRANSFER

Heald transfer-type Bore-Matic arranged for fully automatic drilling, reaming, boring and facing of valve seats and stem holes in automotive cylinder heads. Machine consists of a series of basically standard Heald way-leg units, sequentially machining the work through the various stations to the far end fully automatically.



Heald battery-type Internals permit fully automatic operation of a bank of machines from a single hydraulic power unit. One operator can easily tend several machines.

How Heald AUTOMATION fits into your production plans

AUTOMATION is the newest trend in modern production efficiency. Yet it has occupied the attention of Heald engineers for many years. In fact a number of important developments contributing to fully automatic operation were developed here at the Heald plant more than a decade ago. And research on automation has progressed unceasingly, as witnessed by scores of fully automated transfer machines, way-type Bore-Matics and battery type Internals now operating successfully in the field.

This background of experience is at your disposal—ready to solve virtually any precision finishing problem, carrying it through in many cases from rough casting to finished part. Your nearest Heald representative will welcome an opportunity to show you how Heald AUTOMATION can step up precision and production, with important savings in time and cost factors.

You'll find that IT PAYS TO COME TO HEALD!

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15937 W. Seven Mile Road
Detroit 35, Mich.

DON HARWAY & COMPANY
1709 W. Eighth St., Los Angeles 17, Calif.

MACHINERY, published monthly by The Industrial Press, Emmett St., Bristol, Conn. Executive offices, 148 Lafayette St., New York 13, N.Y.

Subscription Rates: United States and Canada one year, $4; two years, $7; three years, $8; foreign countries, one year, $7; two years, $13. Single copies 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address. Copyright 1955 by The Industrial Press.

Entered as second-class mail matter May 25, 1953, at the Post Office at Bristol, Conn., under the Act of March 3, 1879. Printed in the United States of America.

British Address
National House, West St.
Brighton 1, England

French Address
15, Rue Bleue
Paris-IXe, France

MACHINERY

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The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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LANDIS THREAD

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT-CUTTING-TAPPING-GRINDING-ROLLING

ROLLING MACHINE

NOW *Available!*

LANDIS is now offering a revolutionary new machine for producing threads, not available anywhere else in the Western Hemisphere— the LANHYROL Thread Rolling Machine.

The LANHYROL produces strong, accurate threads of excellent finish by the chipless, cold-forming process—and offers unequalled output, flexibility, and range coverage:

* * * It will produce left- and right-hand threads of all types (except square), including UNC, UNF, Acme, worm, and many special forms.

* * * It will thread all diameters from 3/16" to 3".

* * * Threads are rolled by four distinct methods—Infeed, Thrufeed, Continuous, and Reciprocal. The rolling method used is determined by the length and type of thread and the design and hardness of the workpiece.

* * * Threads can be produced to Class 2 and 3 fit by Continuous Rolling, and to Class 4 fit by Infeed, Thrufeed, and Reciprocal Rolling.

* * * Production rates are high. They vary with the individual operation, but for example—600 pieces per hour, rolling ⅞" 9 pitch UNC threads 1¼" long on 4140 steel of 29C Rockwell hardness, using Infeed Rolling with semi-automatic operation and manual loading.

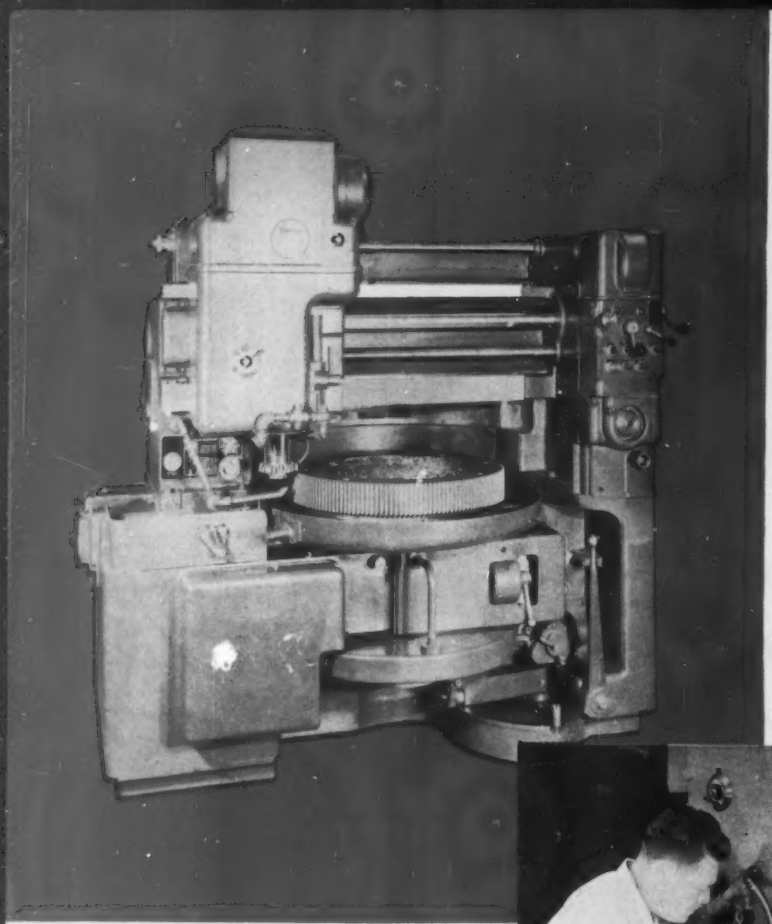
* * * Hopper equipment, automatic operation, and auxiliary equipment for special threads is available.

The LANHYROL Thread Rolling Machine is an important new addition to The Landis Line of Threading Equipment developed by more than 50 years of research and experiment. Additional information on request—please send specifications and ask for Bulletin *E-60*.

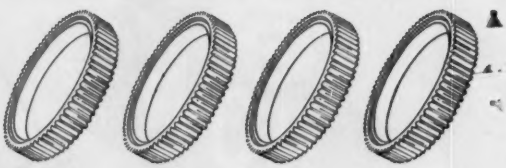
LANDIS *Machine* COMPANY

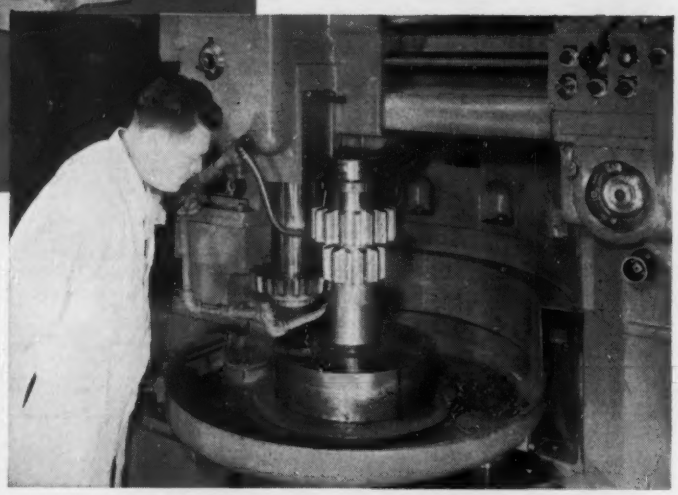
WAYNESBORO • PENNSYLVANIA • U. S. A.

417-C



FELLOWS KEEPS





Standard 36-Type

Fellows Gear Shaper for spur or helical gears in all sizes up to 36″ pitch diameter and 6″ face width, external or internal. Herringbone gears, cams, ratchet teeth, splines, special contours ...all rough and finish cut on one set-up.

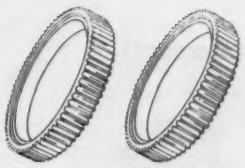
36Z-1 Type

Features 12″ hole in work-spindle for cutting large shank gears, aircraft crankshaft splines, variable pitch propeller blade hub splines and other special items.

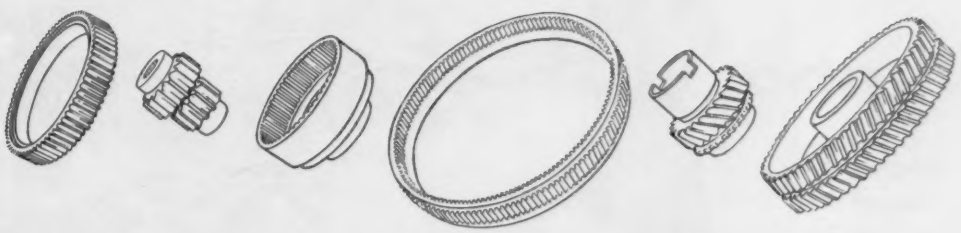
THE *Fellows*

'36'

COSTS DOWN...



whether it's 6,000 of one
... or half dozen of another



Fellows' 36-Type Gear Shaper is a heavy duty machine that really pays off in *both* jobbing shop and mass production operations.

Extra powerful and rigidly constructed... you'll find the 36-Type holds close limits while taking unusually heavy cuts. Result: high speed production of precision gears that keeps costs down!

Set-up time is extra low. Operation is extra easy. A shift of a lever gives a quick change-over from heavy-feed roughing to fine-feed finishing cuts. A selecting dial puts at your finger-tips a choice of 12 cutter reciprocating speeds.

Get the complete facts about this all-purpose gear-cutting machine from your nearest Fellows Office. Write, wire, or phone today!

GEAR SHAPER COMPANY

Head Office and Export Department: 78 River Street, Springfield, Vermont.
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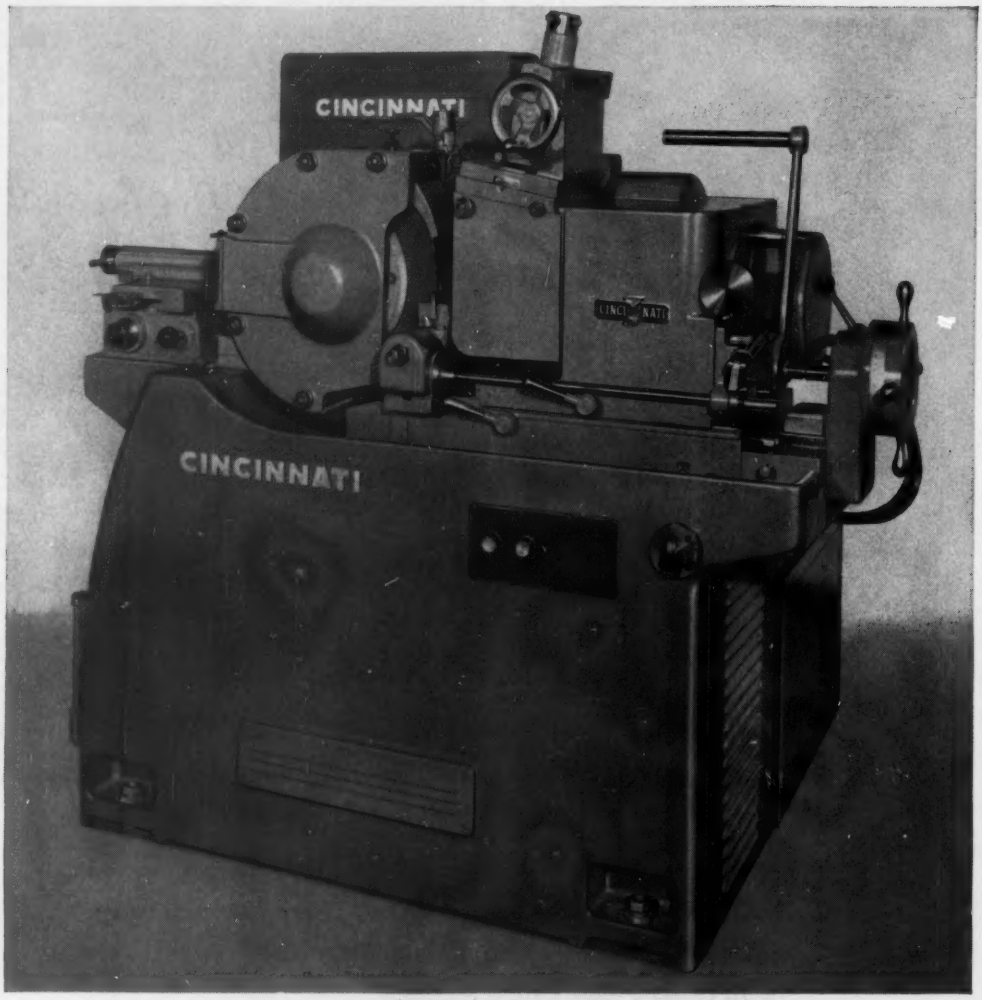
Take a new look at your



CINCINNATI FILMATIC No. 0 Centerless Grinder. Catalog No. G-640.

CINCINNATI

CENTERTYPE GRINDING MACHINES •
MICRO-CENTRIC GRINDING MACHINES

replacement program

the NEW

CINCINNATI FILMATIC No. 0 CENTERLESS GRINDERS . . .

are here today!

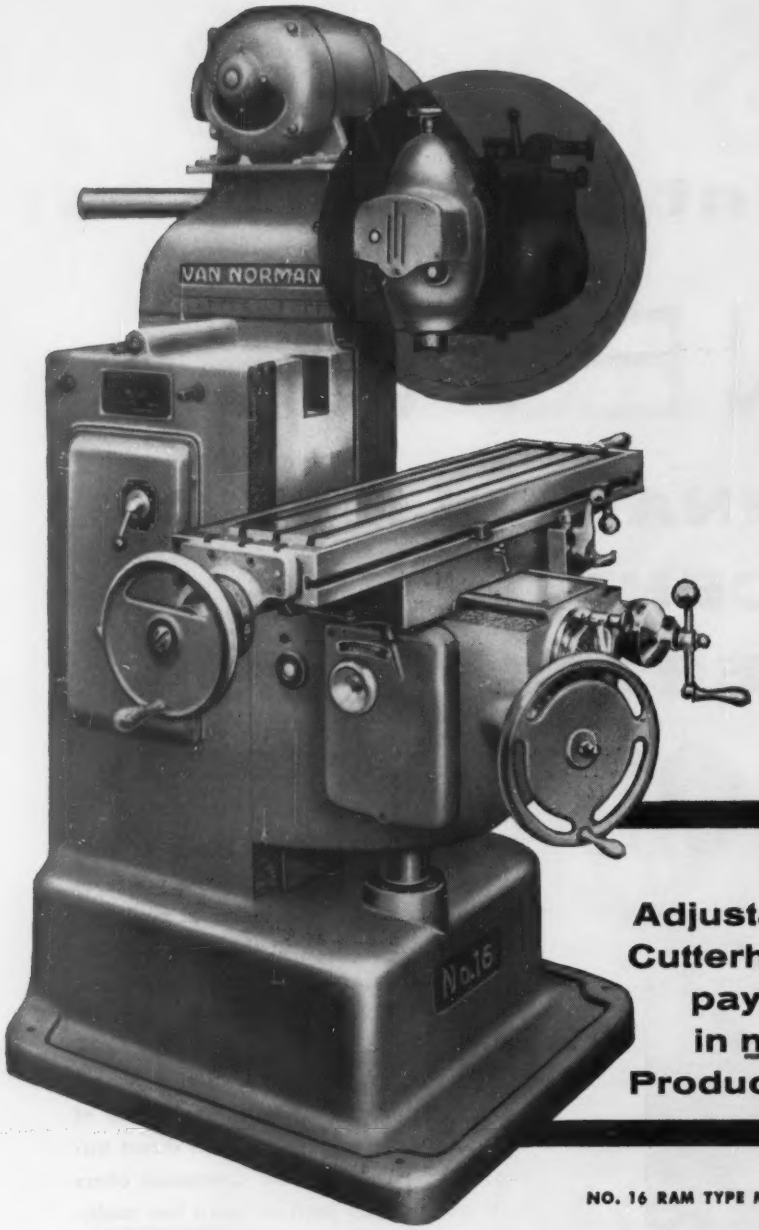
FILMATIC

New machine tools always offer new profit possibilities. In the small parts precision grinding category, a substantial profit potential will be found in the new CINCINNATI FILMATIC No. 0 Centerless Grinders. Exclusive Cincinnati features, based upon 30 years of centerless experience, have been retained: Filmatic grinding wheel spindle bearings; "bed-rock" mounting of grinding wheel spindle; simple, direct truing of wheels. And now Cincinnati offers new advantages such as extra low maintenance with hardened and ground slideways and oil-shot lubrication; an extra measure of production with handwheel selection of infinitely variable regulating wheel speeds; higher quality finish and closer limits of accuracy than ever before. Catalog No. G-640 contains the complete story. Write for a copy today.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

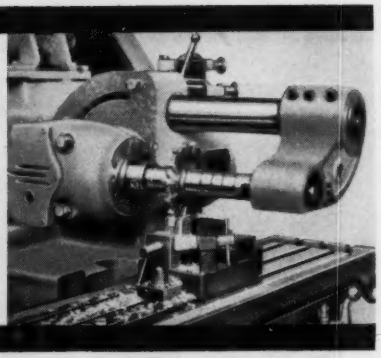
CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

CINCINNATI



ONE does single

The Adjustable Cutterhead pays off in more Production



NO. 16 RAM TYPE MILLER

Conventional horizontal and vertical, as well as angular milling all on ONE miller . . . that's what you get with Van Norman Ram Type Milling Machines. The adjustable cutterhead, mounted on a movable ram, enables you to perform all types of milling by simply positioning the cutterhead in the desired position. Not only does this important feature give you the workability of several single machines, but it also minimizes work set-ups . . . cuts idle machine and operator time by permitting you to meet job to job milling requirements as they occur.

Write for full details today.

HORIZONTAL MILLING

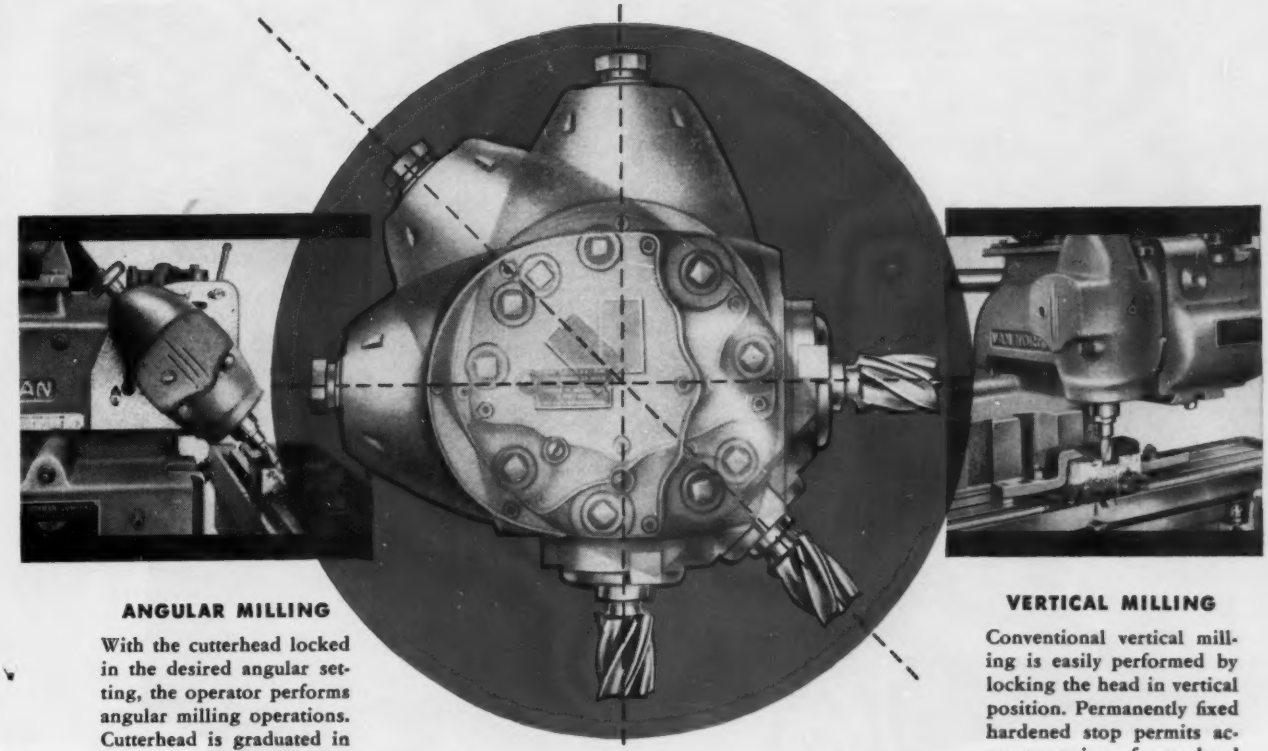
Operator simply swivels the adjustable cutterhead to horizontal position . . . locks it in place . . . and he is ready for horizontal milling. Hardened stop set at factory assures positive 0° setting.

VAN NORMAN

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

Van Norman Ram Type Miller

the work of THREE purpose machines



ANGULAR MILLING

With the cutterhead locked in the desired angular setting, the operator performs angular milling operations. Cutterhead is graduated in degrees from 0° to 90° for easy positioning.

VERTICAL MILLING

Conventional vertical milling is easily performed by locking the head in vertical position. Permanently fixed hardened stop permits accurate setting of cutterhead at 90°.

COMPANY

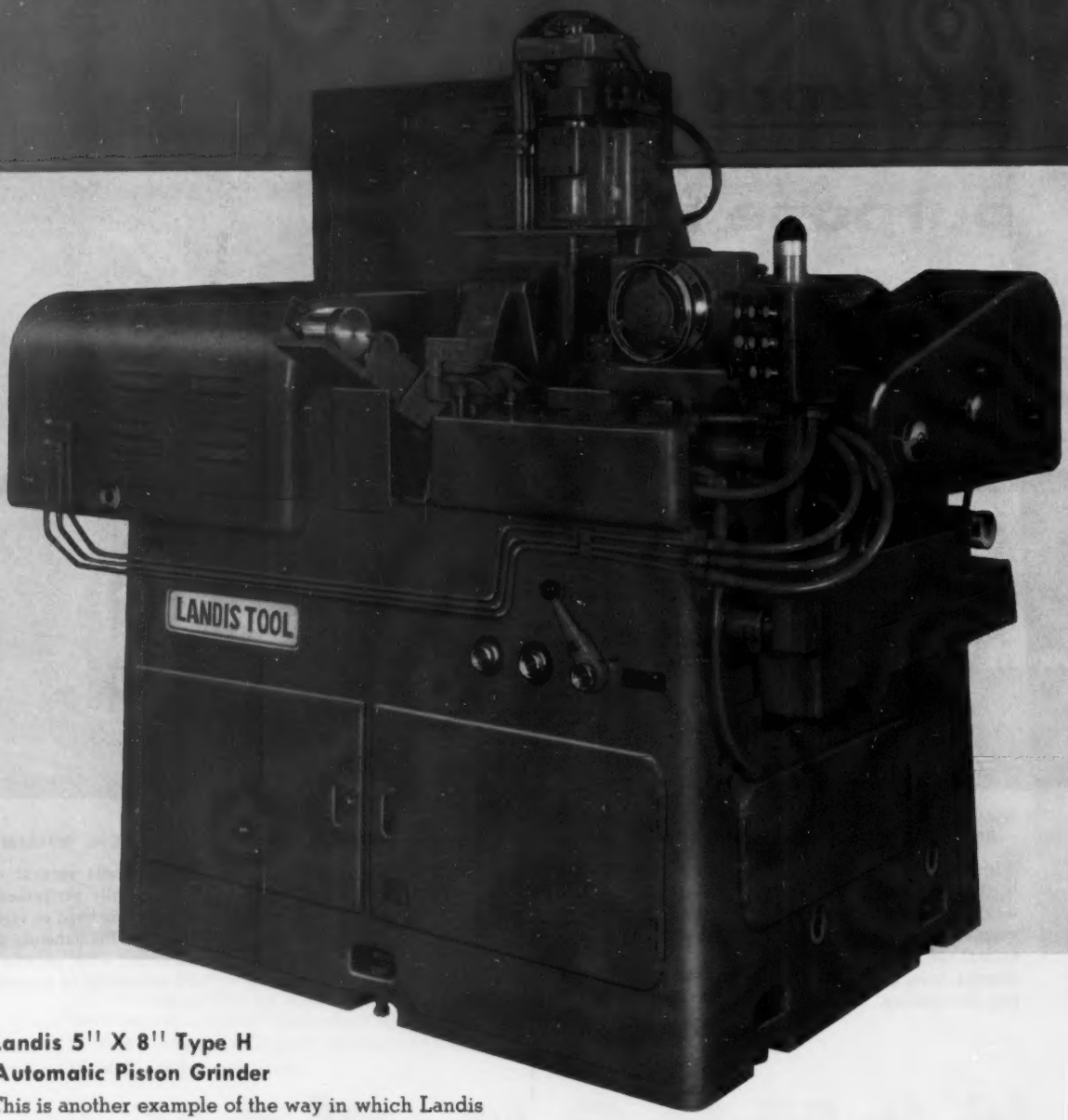
SPRINGFIELD 7, MASSACHUSETTS

Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to 5 years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

Lease and Conditional Sales Contracts not available to Export

AUTOMATION cuts piston

Landis Automatic Piston Grinder



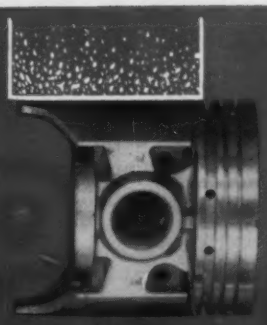
Landis 5" X 8" Type H
Automatic Piston Grinder

This is another example of the way in which Landis solves grinding problems. Recommendations on how to reduce your grinding costs will be made without obligation.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

grinding costs...improves quality

Grinds cam shaped surfaces of 115 pistons per hour removing .015" stock



Automatically Loads Pistons from Conveyor

Automatically Ejects Piston to Conveyor

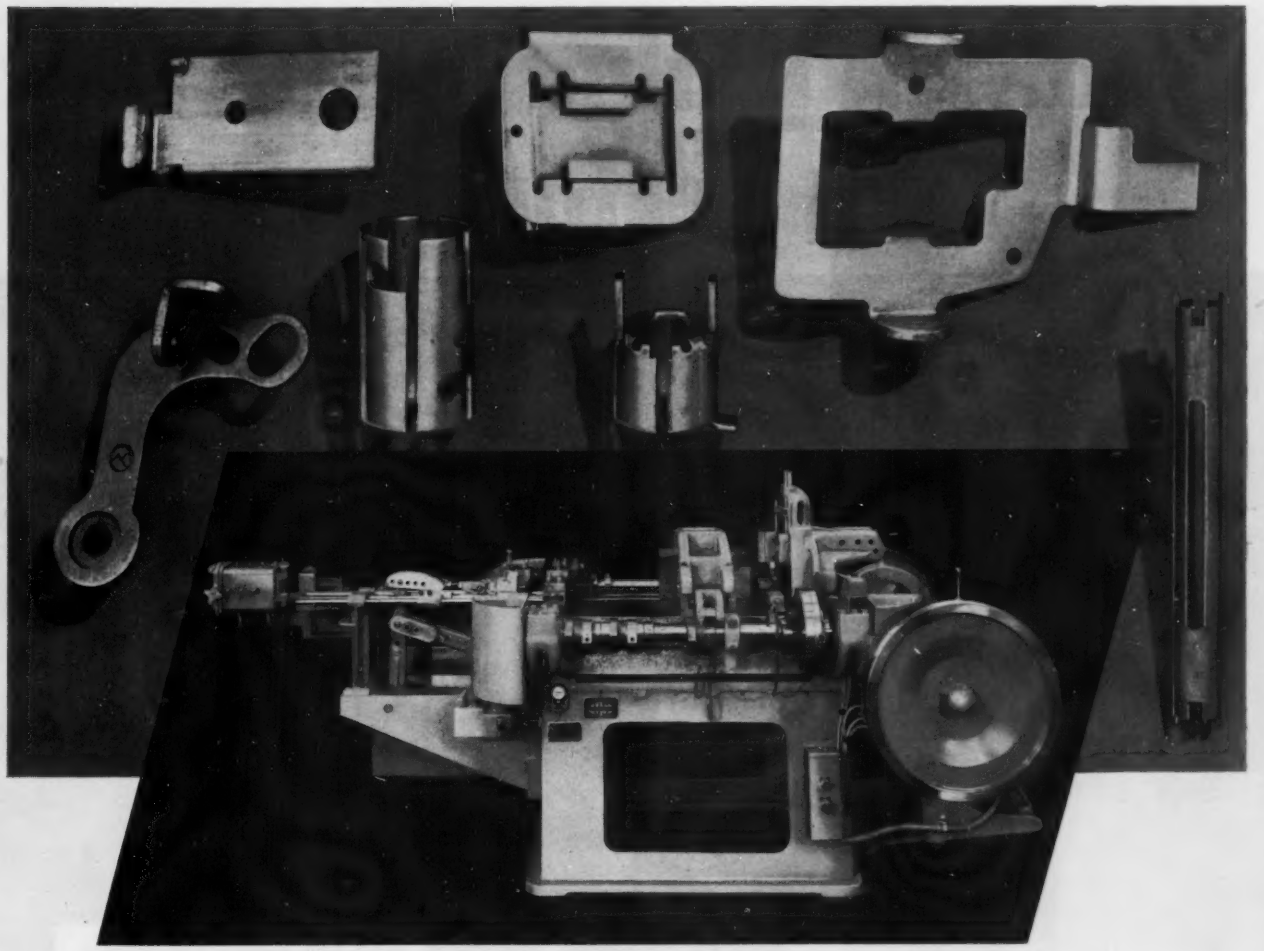
LANDIS

precision grinders

For Automatic Production of Precision Stampings

THE U. S. MULTI-SLIDE®

In the production of precision stampings, every secondary operation, every inspection, every handling helps to send your costs UP! You can keep these costs at a minimum by using U. S. Multi-Slide Machines to produce parts rapidly, accurately, and complete in a single operation. The illustration above shows some typical parts which have been produced in this manner in U. S. Multi-Slides. These parts—of copper, aluminum, brass and steel—illustrate the variety of operations, including piercing, trimming, swaging, coining, blanking and forming, which can be performed in any combination in a U. S. Multi-Slide.



The No. 33 U. S. Multi-Slide, with capacity for material up to 2½" wide, feed length adjustable up to 12½".

Many of these parts formerly required costly secondary operations and intermediate inspections. Now they are produced uniformly and to close tolerances in a single high-speed operation.

U. S. Multi-Slides are built in four sizes.

Illustrated is the No. 33 Machine, with capacity for material up to 2½" wide and feed length adjustable up to 12½".

If your program involves the production of precision stampings, investigate the labor-saving, time-saving features of U. S. Multi-Slides. Ask for a copy of Bulletin 15-M containing complete specifications.

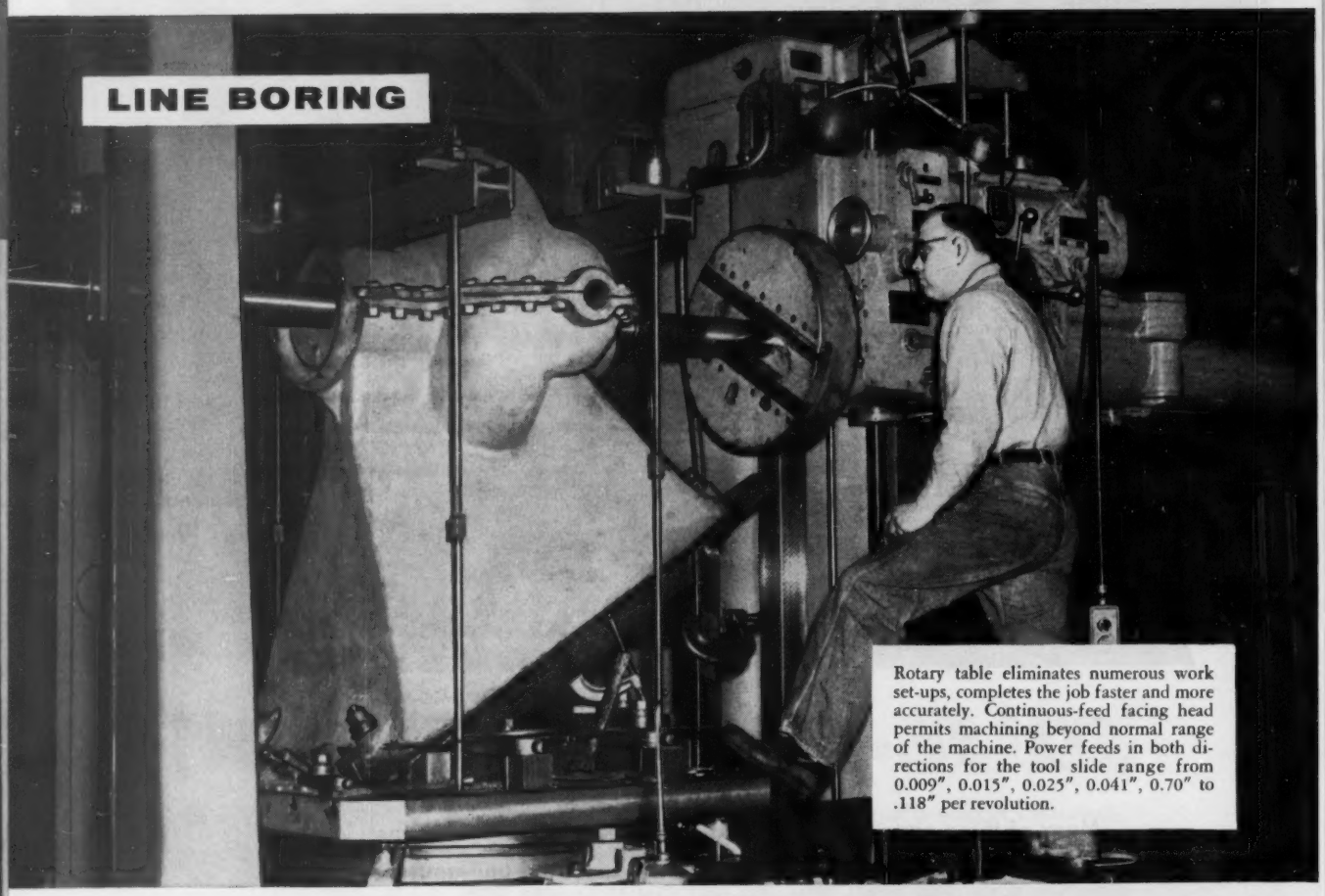
U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

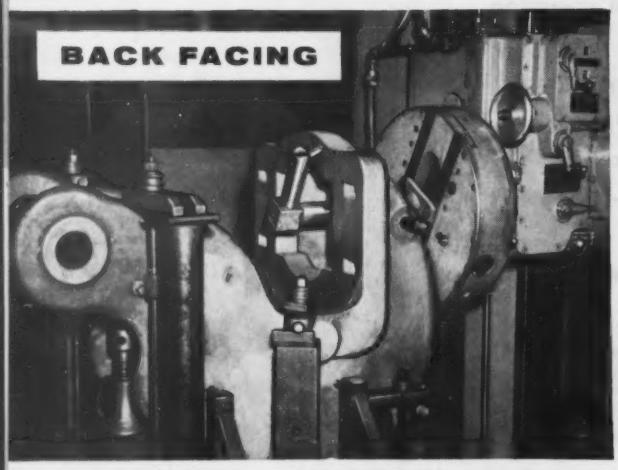
Builders of U. S. Multi-Slides — U. S. Multi-Millers

U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories

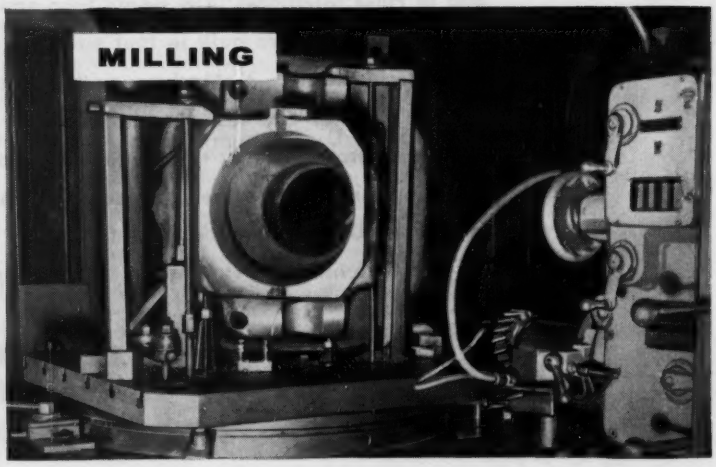
Look at all the operations performs with a



Rotary table eliminates numerous work set-ups, completes the job faster and more accurately. Continuous-feed facing head permits machining beyond normal range of the machine. Power feeds in both directions for the tool slide range from 0.009″, 0.015″, 0.025″, 0.041″, 0.70″ to .118″ per revolution.



Telescopic tool holder extends through bore in workpiece to hold cutter for back facing operation.



Face milling cutter can be mounted quickly. For angular milling a G&L attachment can be used.

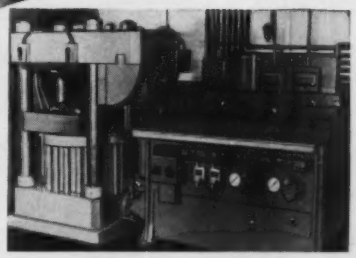
Wilmot Fleming single G&L machine

Here's how to tool-up and set-up workpieces to boost production and profits with a Giddings & Lewis 340-T horizontal boring, drilling and milling machine

Most versatile and busiest machine in the shop of Wilmot Fleming Iron & Steel Co., Philadelphia, Pa. — that's the Giddings & Lewis Model 340-T, horizontal boring, drilling and milling machine. Its ability to increase production, save many man-hours and boost profits, permits this manufacturer to perform a considerable amount of subcontract work. This is in addition to production machining of their own product lines.

With G&L's continuous-feed facing head, rotary table and 45 spindle speeds that are easy to select and change, the Model 340-T enables the operator to perform a broad range of machining operations . . . apply heavier cuts and faster cutting speeds.

Compare this 30 Series machine with any other in its class! You'll discover that feature-for-feature — dollar-for-dollar — you can't buy better.

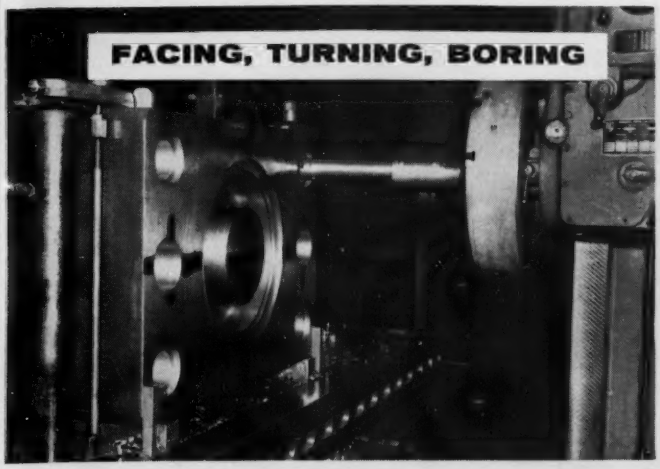


Large and small components of Wilmot Fleming's hydraulic press are precision-machined on G&L's 340-T.

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

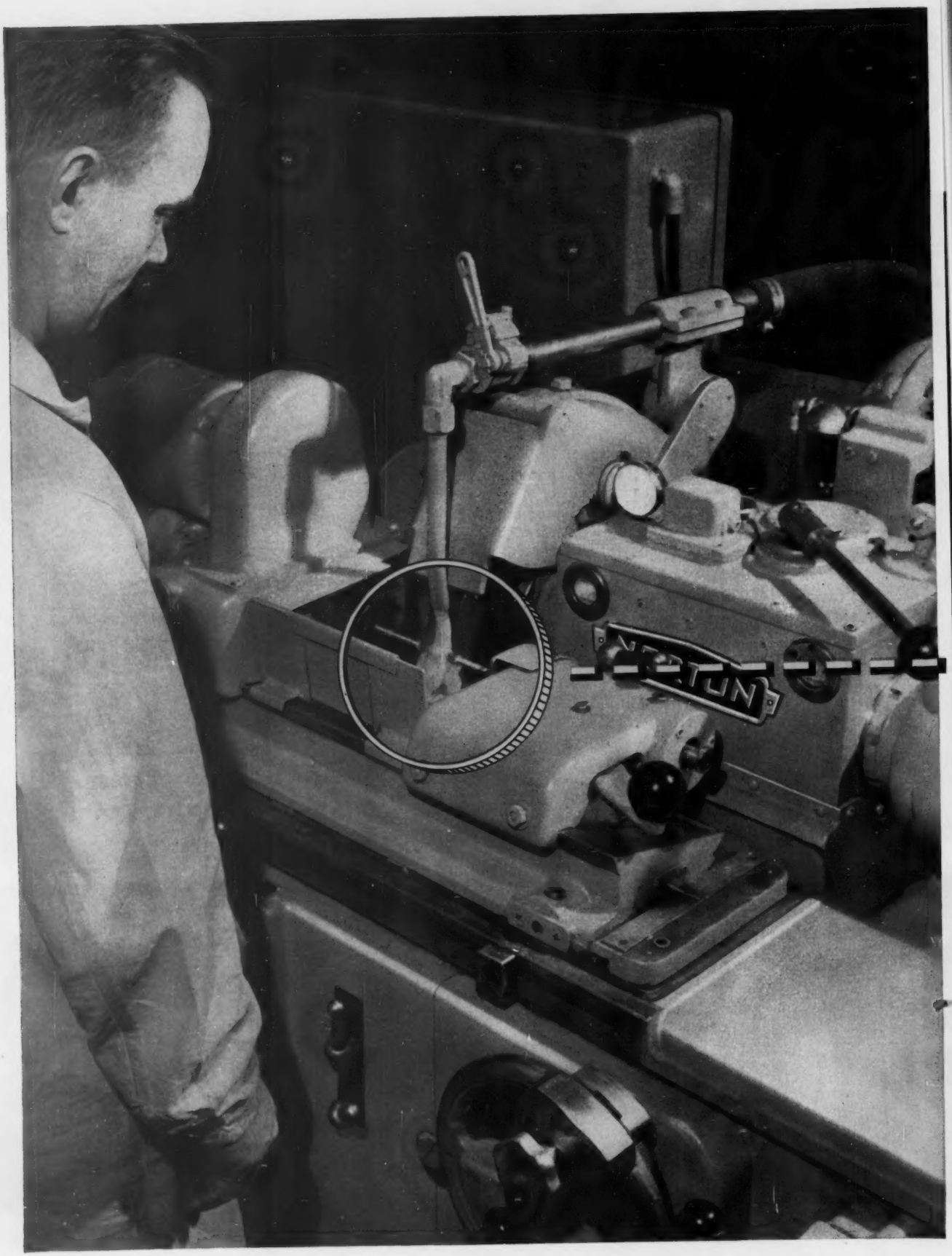
GIDDINGS & LEWIS MACHINE TOOL CO.

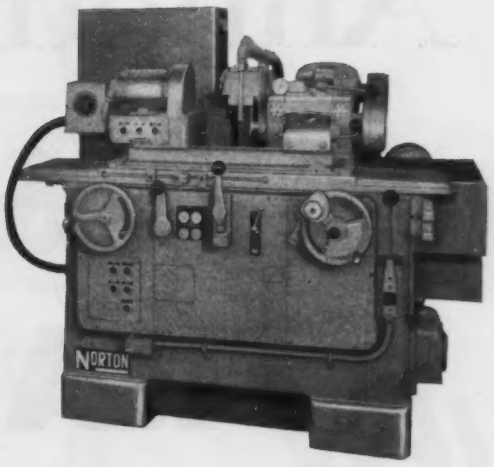
FOND DU LAC, WISCONSIN



With a continuous-feed facing head, facing, turning and boring operations are performed on one set-up.

True directional control for contour milling is accomplished manually or through power feed.





New Norton 4"x18" Type CTU Cylindrical Grinder

gives you high precision plus high production . . .

makes small parts pay off big

Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations.

Either way you get faster, more accurate, more profitable grinding of a wide variety of small parts. Because either way the 4" Type CTU's Norton-developed features bring a new ease of operation for your men — and a new high in production quality and quantity for *you*.

To name just one of these advanced features, there's the extremely rugged wheel spindle unit that assures enduring precision in jobs ranging from heavy stock removal to fine finishing. But why not get the whole story of this speedy, profit-boosting grinder from your Norton Representative?

Write for Catalog No. 531. And remember: only Norton offers you such long experience in both grinding wheels and machines — to help you produce better products at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass.

***To Economize, Modernize With* NEW**

NORTON

GRINDERS *and* LAPPERS

Making better products . . . to make other products better

District Sales Offices: Hartford • New York • Cleveland • Chicago • Detroit • *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5, Ontario

For more information on products advertised, use Inquiry Card, page 255

Announcing...

Kearney & Trecker's NEW RAM HEAD

plain and universal milling machines

KEARNEY & TRECKER'S new line of Ram Head milling machines combines a conventional horizontal spindle and a self-contained motorized sliding ram. As a result, horizontal and vertical spindles can be run separately and simultaneously.

The Ram Head machines are available with a choice of three heads — Universal, Vertical and Quill types which can be rotated through 360°. You can perform vertical, horizontal and angular milling on one machine *in a single setup.*

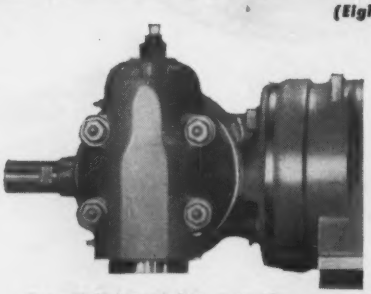
Ram Head machines are highly versatile and exceptionally economical for general purpose production milling. They are built in Model CH, CK and CSM designs with 69 different machines in sizes from No. 2 to No. 4 in both plain and universal styles. Machines may be equipped with either Standard Directional Table Control, or Mono-Lever and Automatic Cycle Table Control.

To afford greater versatility with minimum maintenance, the Ram Head is individually motor-driven . . . has its own lubrication system and speed change mechanism. When used as a standard horizontal machine, the ram acts as a heavy-duty arbor support.

For the full story, contact your nearest Kearney & Trecker representative, or write: Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

with choice of three types of heads

(Eight spindle speeds in three optional ranges)

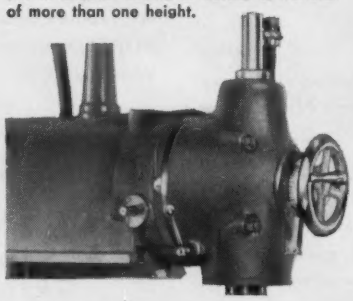


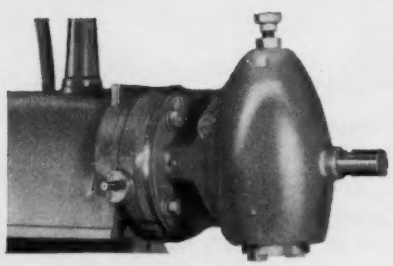
Type U Universal Swivel Head

Capable of numerous milling combinations, this Universal Swivel Head has two graduated bases at right angles to each other, both of which can be swiveled through 360 degrees. Head is rotated by worm and worm wheel with adjustment by hand crank.

Type Q Adjustable Quill Swivel Head

Spindle can be set at any angle through 360 degrees. This Ram Head has a 3½" hand-feed quill movement. In addition, four-position micrometer stop and dial indicator permit angular milling or boring operations of more than one height.



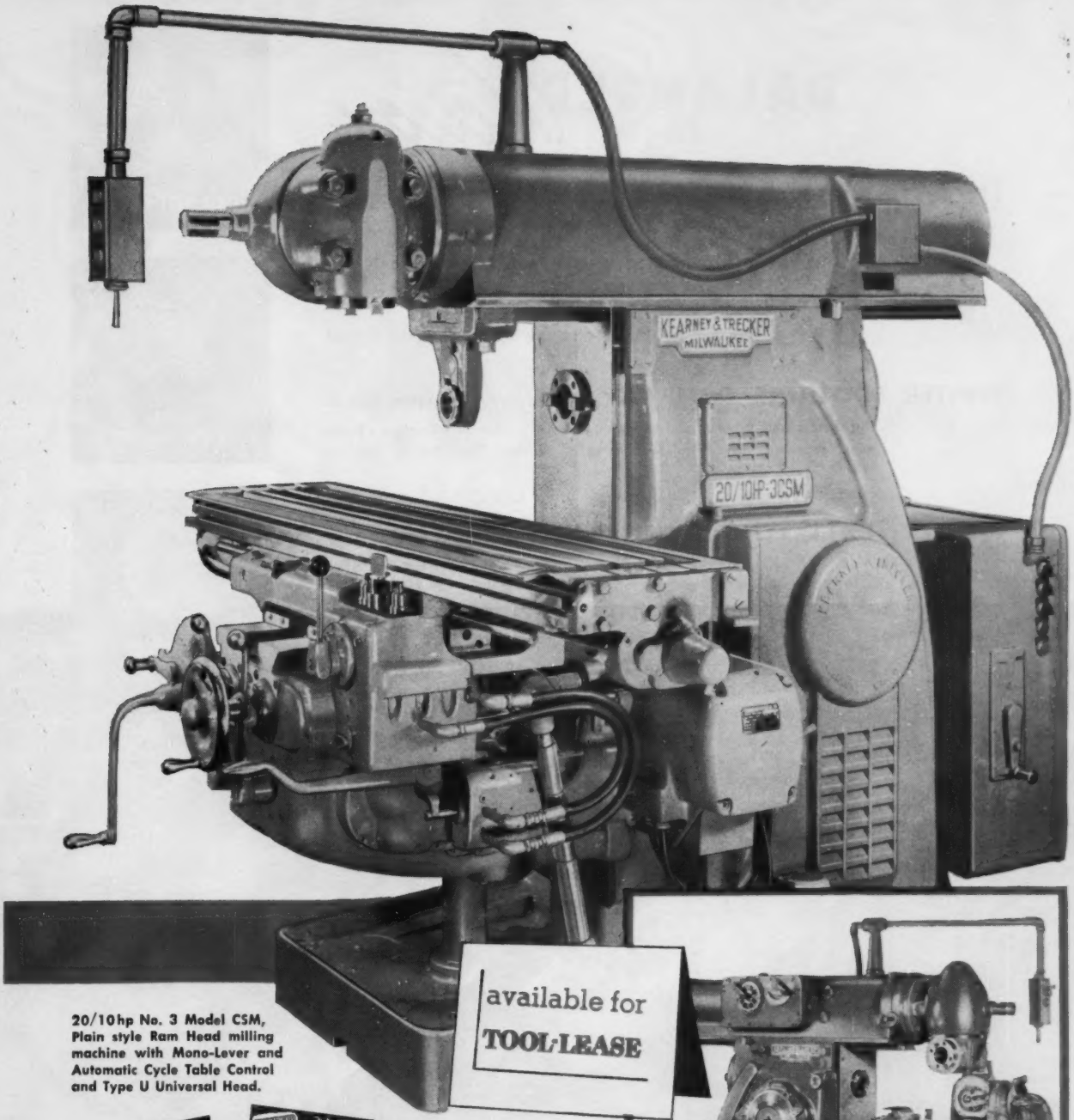


Type V Vertical Swivel Head

Especially adapted for vertical and angular milling operations. Spindle housing base of Vertical Swivel Head is graduated. Spindle can be set at any angle up to 360 degrees.

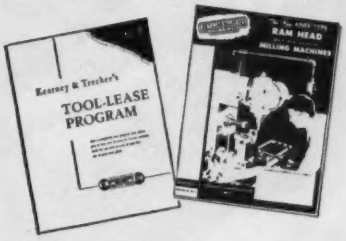
Kearney & Trecker Corporation

MILWAUKEE 14, WISCONSIN



20/10hp No. 3 Model CSM, Plain style Ram Head milling machine with Mono-Lever and Automatic Cycle Table Control and Type U Universal Head.

available for **TOOL-LEASE**



FREE CATALOGS!

Ask for catalog No. RH-10A for complete data on Ram Head plain and universal milling machines, and Tool-Lease bulletin, TL-10A. Also see our catalog in SWEET'S.

7½ hp No. 3 Model CH, Universal style Ram Head milling machine with standard Directional Table control and Type U Universal Head.

BALANCED *Action*

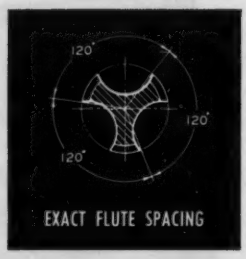
In Special Application Taps, Too!

It pays to use *Special Application Winter Taps* when working with aluminum, plastics, zinc, cast iron. Like all Winter taps, *they operate with balanced action.*

WINTER BROTHERS COMPANY, Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.

CALL YOUR WINTER DISTRIBUTOR



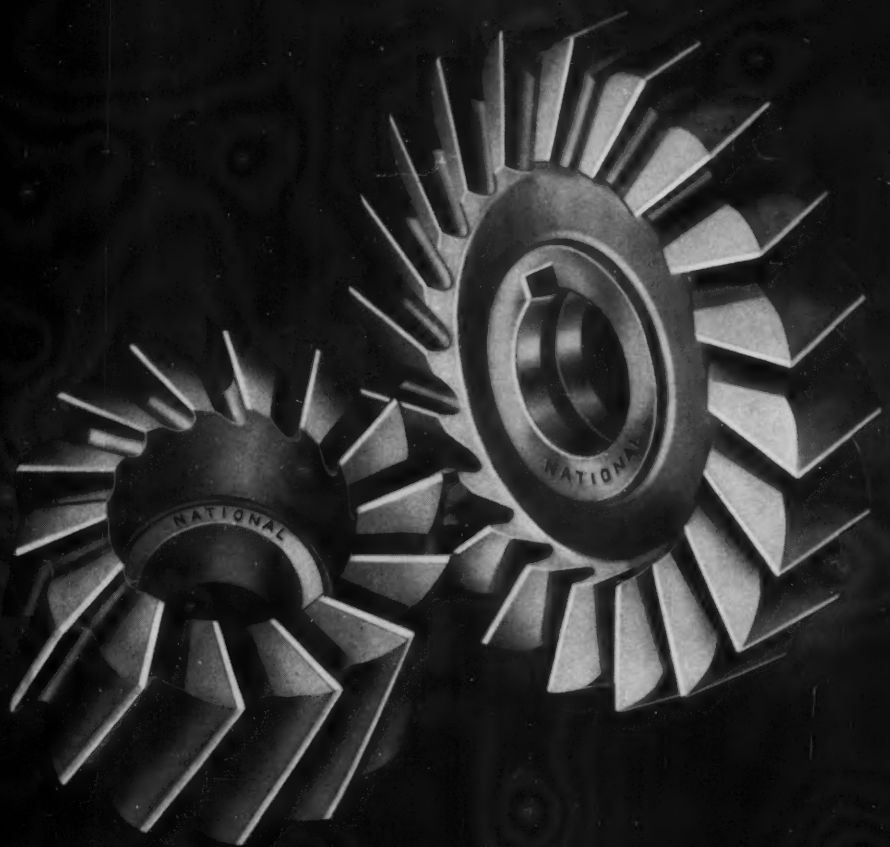
EXACT FLUTE SPACING

UNIFORM FLUTE CONTOURS

PRECISION CHIP DRIVER CONTOURS

ACCURATE AND CONCENTRIC CHAMFERS

WINTER



National

NATIONAL TWIST DRILL & TOOL CO. ROCHESTER, MICH. U.S.A.

Long Life Between Grinds

Give yourself the edge in production economy. Use Milling Cutters with the dependable National cutting edges, designed with the proper rake angles for your work.

National milling cutters in stock cover a very wide application range. Also, National will design and build "specials" to fit your needs.

CALL YOUR NATIONAL DISTRIBUTOR

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U. S. A. Distributors in principal cities. Factory Branches: New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles

TWIST DRILLS • REAMERS • COUNTERBORES • MILLING CUTTERS • END MILLS • HOBS • SPECIAL TOOLS

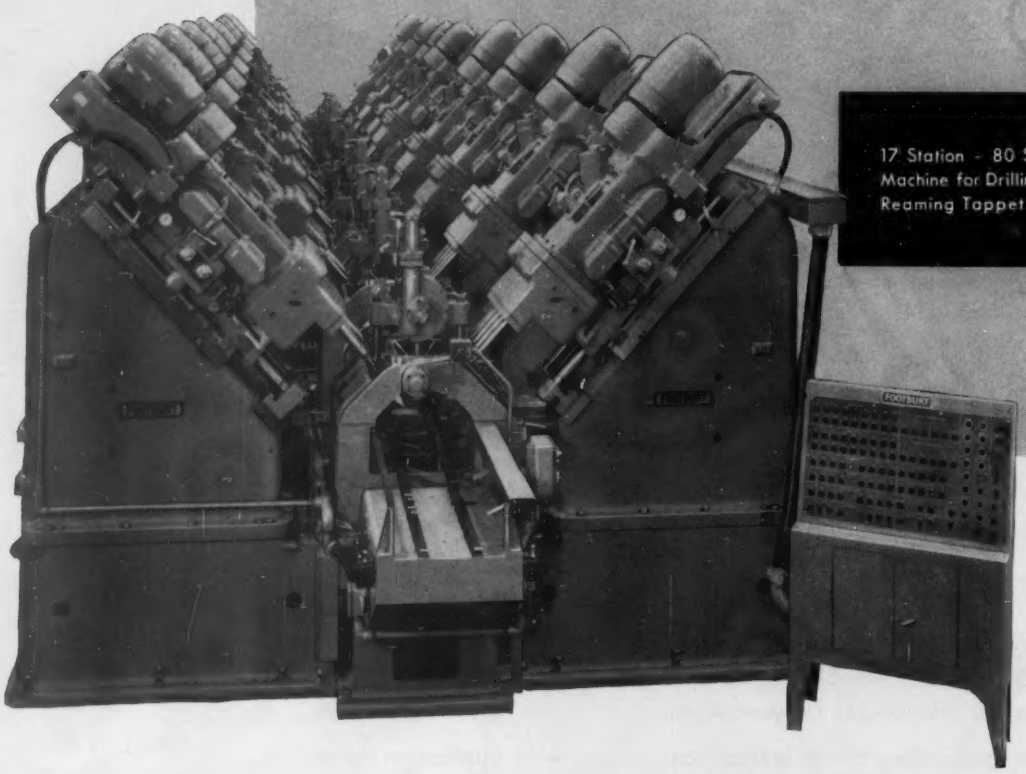
FOOTBURT

STATION TYPE MACHINES

Production-wide engineers in leading automotive plants are specifying Footburt Station Type Equipment on cylinder blocks and cylinder heads as the most advanced method in quantity manufacturing. Similar operations that ordinarily require several separate machines are grouped in one station machine, thus greatly reducing handling and providing better production control. Combining of valve hole operations, cylinder boring, the majority of drilling and tapping operations are outstanding examples of this latest production trend.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building



17 Station - 80 Spindle Machine for Drilling and Reaming Tappet Holes.

engineered for production

FOOTBURT

MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 255

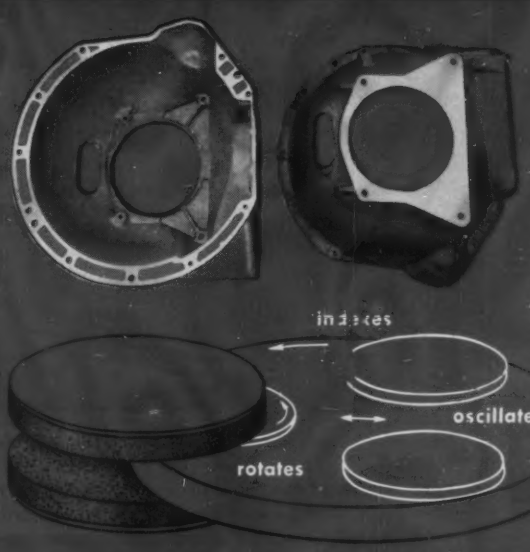
TWO Unequal Parallel Areas Ground in ONE Operation

Heavy stock removal... close tolerances... high production!

Job Data	
MACHINE	Gardner No. 204-40" & 36" Vertical Double Spindle Grinder.
PART	Aluminum torque converter housing.
PRODUCTION	90 per hour, both sides.
STOCK REMOVAL	.070" overall. (Rough & finish in one operation.)
TOLERANCES	.002" for flatness; .002" for parallelism; .010" for uniformity.
ABRASIVES	2 Gardner Yellow Rim Wire-Lokt Discs.

GARDNER MACHINE COMPANY
Beloit, Wisconsin, U. S. A.

133M



Grinds by "Floating" Principle of Gardner Grinding

GARDNER
precision disc grinders

Some PINION!

by PHILLIE GEAR®

Spur
Helical
Spur Internal
Helical Internal
Rack
Herringbone
Worm
Non-Metallic
Splines
Coniflex Bevel
Spiral Bevel
Zerol
Hypoid
Intermittent
Sprockets

Contract machine work

Yes, it *is* "some Pinion" *54"* diameter, 30" face width and weighing 4,600 lbs. . . . but it is just part of a day's work at "Phillie Gear."
Here in one of the World's largest and most modernly equipped gear plants are all the latest machines, methods and craftsmen necessary to produce accurate gears of any type, size and quantity.
When you require gears for any purpose, consult our Engineering Staff for courteous service and prompt action.

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA
VIRGINIA GEAR & MACHINE CORP. • LYNCHBURG, VA

Industrial Gears & Speed Reducers

LimiTorque Valve Controls

ESTABLISHED 1892

For more information on products advertised, use Inquiry Card, page 255

Why CIMCOOL scores with operators

. . . IT DOES A BETTER JOB AND MAKES JOBS BETTER! This radically new and different cutting fluid cools so fast that workpiece, tools and chips actually stay cool to the touch. And CIMCOOL° is clean—doesn't soil hands . . . leaves no hazardous slippery film on hands, work, machine or floor . . . and contains no skin irritants.

CIMCOOL wins over old-fashioned coolants because it's a *chemical emulsion*. It replaces all but a few highly compounded specialty oils. It permits faster speeds and it increases tool life because it combines friction reduction and cooling capacity in a degree never before attained. It's longer lasting in machines. So CIMCOOL reduces downtime and cuts labor costs for cleaning and changing.

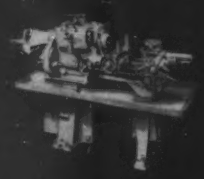
Let a demonstration in one of your own machines convince you that this revolutionary cutting fluid *makes jobs better* . . . and *does a better job*. Just write us and we'll have one of our Cincinnati Milling-trained machinists call on you — without cost or obligation. Or, if you prefer, write for our free booklet, "Cimcool Defeats Heat." Address Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

RAM TYPE TURRET LATHES



NO. 2 ALL-GEARED HEAD
1" Bar Capacity
14" Swing

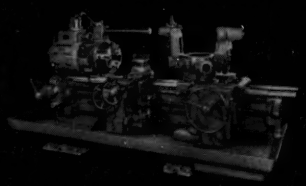
NO. 3 UNIVERSAL
1½" Bar Capacity
15⅜" Swing

NO. 4 UNIVERSAL
2" Bar Capacity
18⅛" Swing

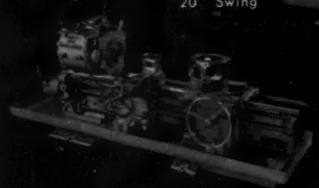
NO. 5 UNIVERSAL
2½" Bar Capacity
20" Swing

SADDLE TYPE TURRET LATHES

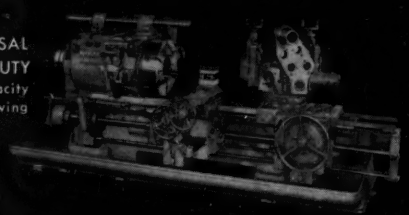
1-A UNIVERSAL
HEAVY DUTY
2½" or 3" Bar Capacity
16¼" Swing



2-A UNIVERSAL
HEAVY DUTY
3½" Bar Capacity
20" Swing



3-A UNIVERSAL
HEAVY DUTY
4½" or 6" Bar Capacity
23½" Swing



4-A UNIVERSAL
HEAVY DUTY
8" 9" or 12" Bar Capacity
28¼" Swing

PRECISION TAPPING AND THREADING MACHINES

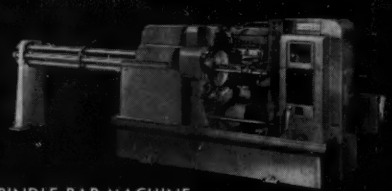
NO. 10
TAPPING MACHINE
0-80 to 10-24 Capacity

NO. 11
TAPPING MACHINE
8-36 to 7/16" Capacity

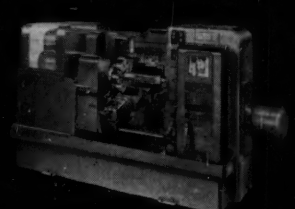
NO. 11 RS RADIAL (Single Head)
NO. 11 RD RADIAL (Double Head)
8-36 to 7/16" Capacity

NO. 12
TAPPING MACHINE
3/8" to 2½" Capacity

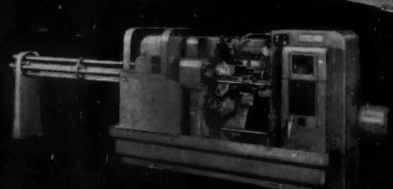
MULTI-SPINDLE AUTOMATICS



6-SPINDLE BAR MACHINE
¾" or 1¼" Bar Capacity



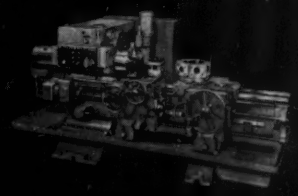
5-SPINDLE
CHUCKING MACHINE
6" Swing



5-SPINDLE BAR MACHINE
1¾" Standard Bar Capacity
2¼" Oversize Capacity

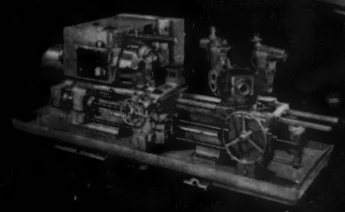
YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &

SADDLE TYPE TURRET LATHES

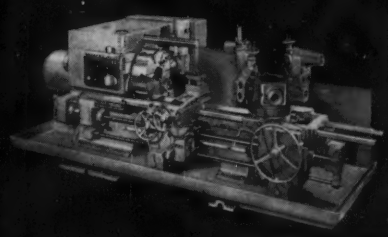


1-A UNIVERSAL
EXTRA-HEAVY DUTY
2½" or 3" Bar Capacity
16¼" Swing

2-A UNIVERSAL
EXTRA-HEAVY DUTY
3½" or 4½" Bar Capacity
20" Swing



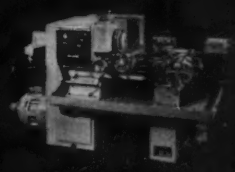
3-A UNIVERSAL
EXTRA-HEAVY DUTY
4½" or 6" Bar Capacity
23½" Swing



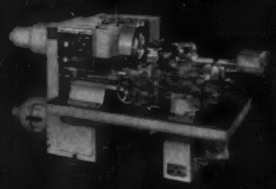
4-A UNIVERSAL
EXTRA-HEAVY DUTY
9" or 12" Bar Capacity
28¼" Swing

ELECTRO-CYCLES

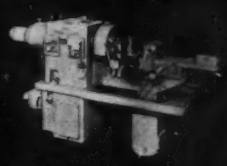
NO. 1 ELECTRO-CYCLE
⅜" Bar Capacity
11" Swing



NO. 2 ELECTRO-CYCLE
1" Bar Capacity
14" Swing

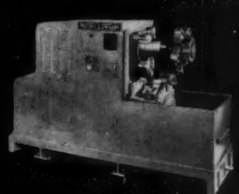


NO. 3 ELECTRO-CYCLE
1½" Bar Capacity
15⅜" Swing

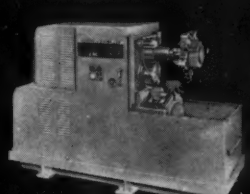


16" ELECTRO-CYCLE
1⅞" Bar Capacity
16⅞" Swing

SINGLE SPINDLE AUTOMATICS

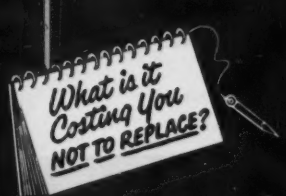


1 AC CHUCKING MACHINE
8" or 10" Chuck — 6" Working Stroke



2 AC CHUCKING MACHINE
10" or 12" Chuck — 9" Working Stroke

When the going gets tough ...put it on a WARNER & SWASEY



WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

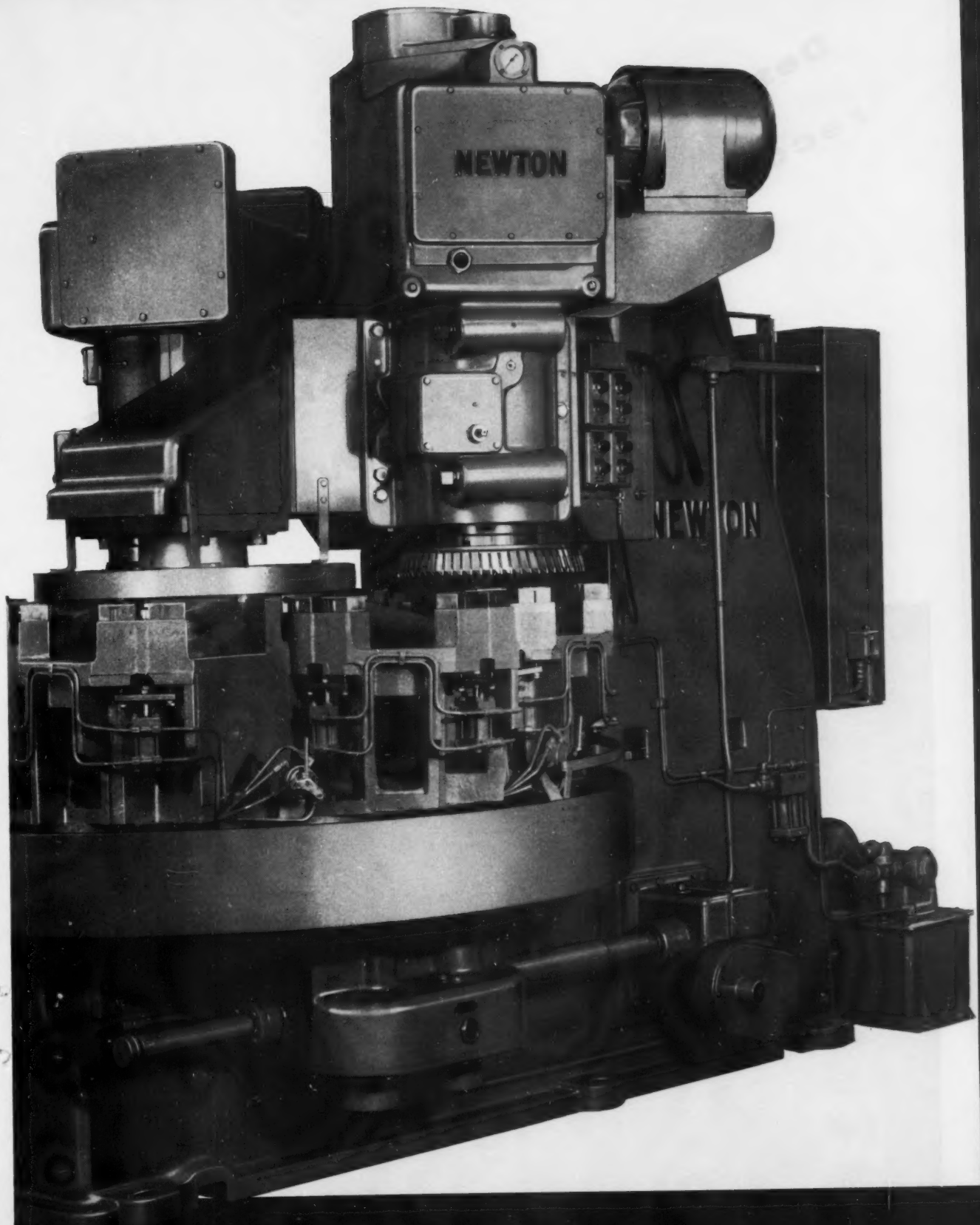
Multiple Milling

Where you have work pieces to be milled on two sides, you can mill both sides on NEWTON VERTICAL ROTARIES in the time required to mill only one side by using double-row fixtures.

This 76 Inch NEWTON VERTICAL ROTARY with double-row fixtures continuously roughs and finish mills two sides of a piece in one pass under the cutters. The fixtures (hydraulically operated) automatically open and close as the table turns.

CONSOLIDATED MACHINE TOOL

Wholly owned subsidiary of Farrel-

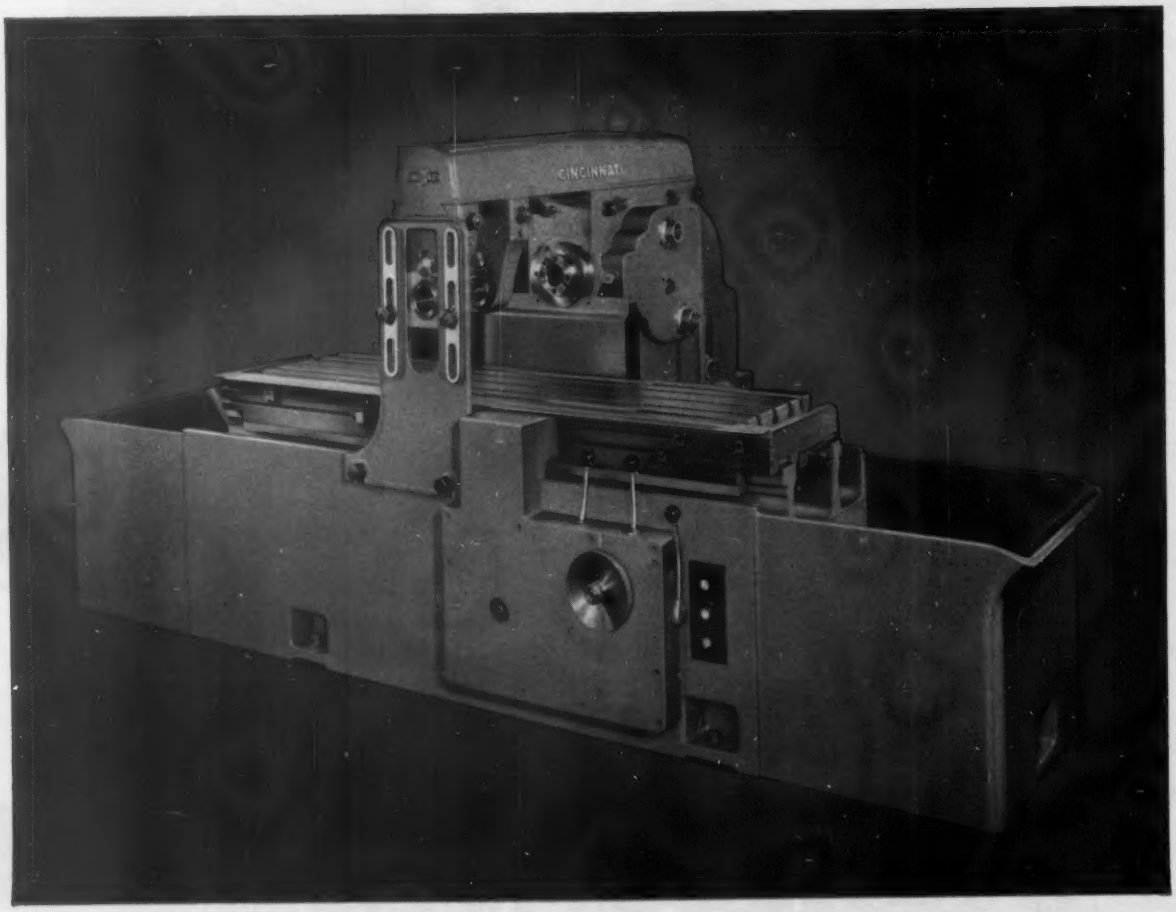


CORPORATION, ROCHESTER, N. Y.

Birmingham Company, Incorporated

Destined to make an outstanding record in reducing costs . . . . .

HyPowermatic



New CINCINNATI HYPOWERMATICS are the world's finest heavy duty automatic milling machines . . . they are worthy of the immediate attention of your replacement committee. ¶ These new machines are built in 42 sizes, plain and duplex styles, 36" to 168" table traverse, up to 50 hp drive. Outstanding time and effort saving features include Dynapoise overarm, Hydramech table drive, backlash eliminator, automatic spindle stop. More details in catalog No. M-1871. Write for your copy today.

NEW CINCINNATI MILLING MACHINES

CINCINNATI No. 420-184 HyPowermatic Milling Machine with Automatic Quill Retraction.

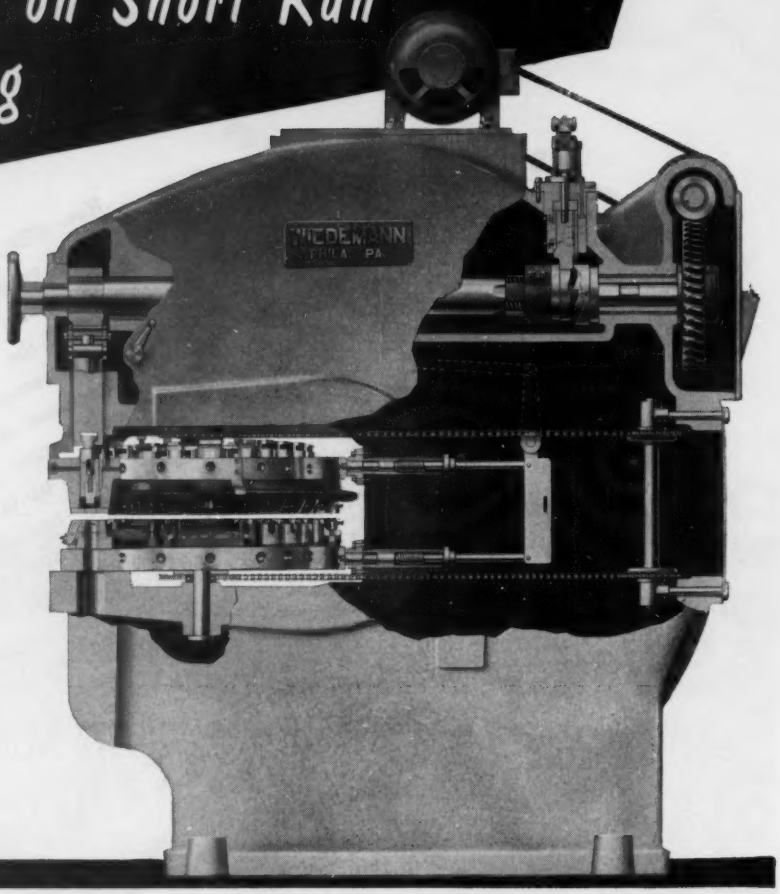
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

CINCINNATI

THE WIEDEMANN R-61
TURRET PUNCH PRESS
Pays Off on Short Run Piercing



- *Eliminates 50% to 90% down time.*
- *Provides unlimited flexibility.*
- *Maintains close tolerances.*
- *Pays off in 2 years or less.*

Holes are located and pierced in flat sheet metal or plates without layout or setup by the Wiedemann R-61. Rugged design and construction of this turret punch press assures many years of maintenance-free operation. The original investment is realized in production savings many times.

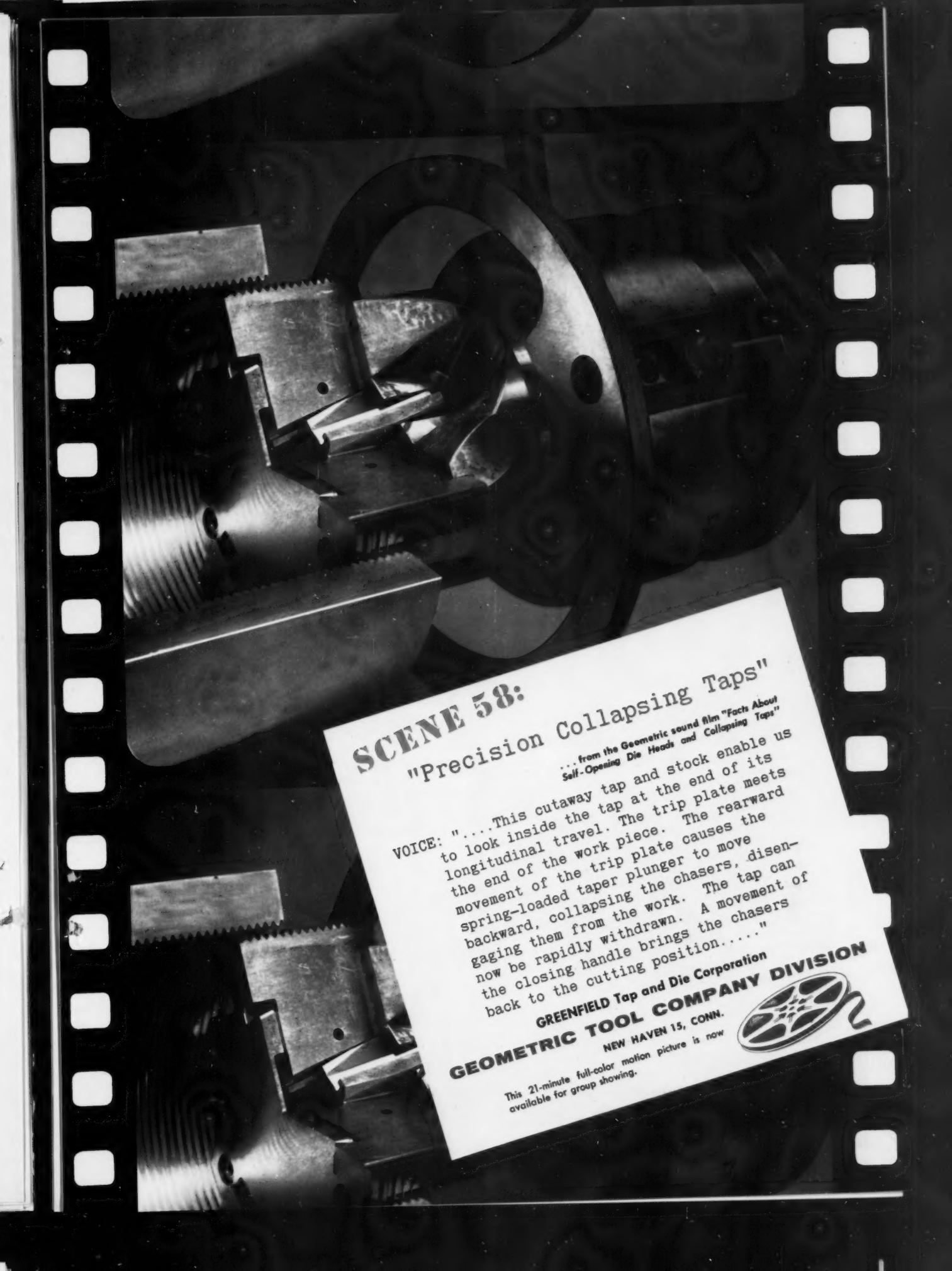
SEND FOR NEW R-61 BULLETIN

. . . describes in detail the application, operation and construction of the turret punch press.

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Avenue, Philadelphia 32, Pa.

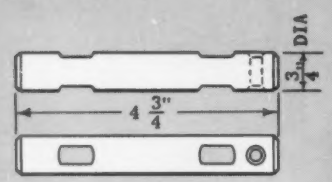
For more information on products advertised, use Inquiry Card, page 255


SCENE 58:
"Precision Collapsing Taps"
...from the Geometric sound film "Facts About Self-Opening Die Heads and Collapsing Taps"
VOICE: "....This cutaway tap and stock enable us to look inside the tap at the end of its longitudinal travel. The trip plate meets the end of the work piece. The rearward movement of the trip plate causes the spring-loaded taper plunger to move backward, collapsing the chasers, disengaging them from the work. The tap can now be rapidly withdrawn. A movement of the closing handle brings the chasers back to the cutting position....."
GREENFIELD Tap and Die Corporation
GEOMETRIC TOOL COMPANY DIVISION
NEW HAVEN 15, CONN.
This 21-minute full-color motion picture is now available for group showing.

THERE'S ONLY ONE WAY TO DO A JOB BEST... *Another Production Solution*

by MOTCH & MERRYWEATHER!

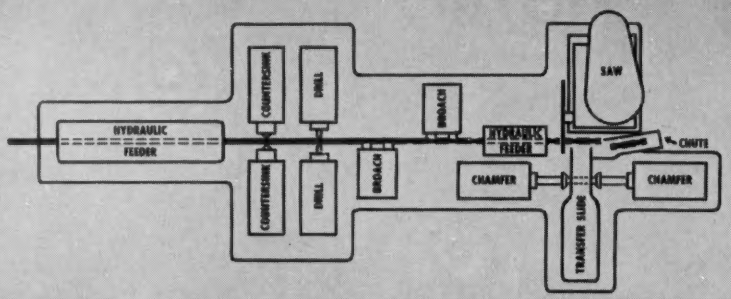
THE JOB TO BE DONE

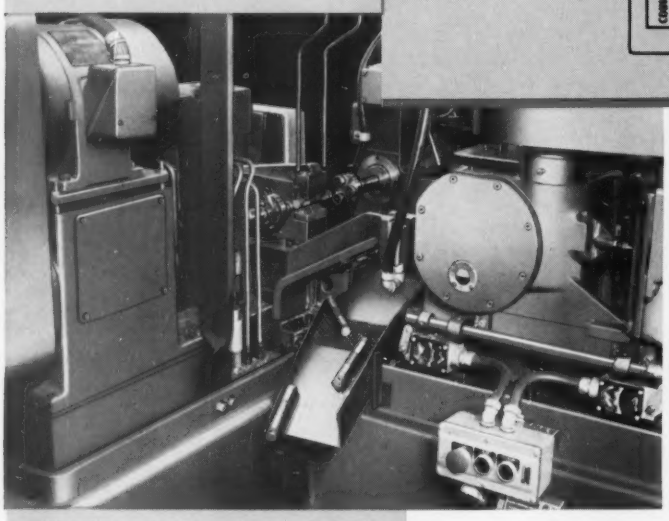


Part: Differential pinion shaft.

Operations: Countersink, drill, broach two sides, Triple-Chip cut off, and chamfer both ends.

HOW M & M DID IT BEST





M & M attained production of 300 pieces per hour at 100% efficiency.

Again, the one best answer is by a Motch & Merryweather in-line automatic transfer machine, designed and built for this one purpose. In-line speedy progression — no wasteful starting and stopping — stock clamping at each station — automatic stock bar loading can be added for complete automation. *Result:* rapid fire production that quickly pays out. This in-line machine is but one illustration of a production solution by Motch & Merryweather.

Ask us now for any production-machining aids. No obligation.

By combining operations, production was increased with a minimum of floor space and labor required.

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders of Circular Sawing Equipment, also Production Milling, Turning, and Special Machines

For more information on products advertised, use Inquiry Card, page 255

Every little spark stream has a meaning all its own

Upper photo, HIGH CARBON STEEL . . . lower left, TITANIUM . . . lower right, HI-SPEED STEEL.

Touch a grinding wheel to a bar or billet, and a trained spark-tester can tell you what the metal is—even what the alloy is—by observing the spark pattern. Many companies use this method to double check the metals used in manufacture. It is one thing to choose a grinding wheel for spark testing—quite another to choose one for production grinding. The spark stream from your grinding machine tells a different story—a *profit* story—when you use grinding wheels by CARBORUNDUM. Profitable grinding is possible only with the wheel that suits your production demands, your machine, your operator. Making *sure* you get the right wheel for every purpose is a cardinal rule at CARBORUNDUM. For proof, call your Distributor or Salesman today.

Through application "know-how" and product quality

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

Hind-side as sandy as fore-side

Use *both* sides of SAND SCREEN for sanding and finishing...do from 7 to 15 times more work with one sheet or disc than you can with conventional coated abrasives. Removed material flows through the open mesh—you sand faster, longer, with much less loading. Use SAND SCREEN wet or dry...for hand or machine finishing. Fold it—tear it to any convenient size. CARBORUNDUM'S SAND SCREEN Discs and FASTCUT Pad 85 Assembly slash time and costs on wet sanding of prime coats. On many operations of sanding flats and slight contours, no adhesives are necessary. Cut sheets fit oscillating or vibrating sanders... do a terrific job wherever loading and glazing is a problem. Get samples today from your CARBORUNDUM Distributor or Salesman.

Through product quality and application "know-how"

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

these thread rolling production pictures* would look good in any shop!

Report from Plant #1

"This shop has been rolling 3/8"-16 threads continuously for two months – at 2000 rpm. Still on first set of rolls. 350,000 pieces to date."

Report from Plant #2

"Have three machines rolling 7/16"-20 threads on C-1114 steel studs – 'Close to a million' so far – and rolls have not been turned around*"

(*Thread Rolls are reversible, having a lead of 1⅓ to 1¾ threads on both sides.)

**Taken from two recent National Acme sales reports. More information on request.*

These two reports show that National Acme (Fette Patent) SELF-OPENING Thread Rolling Heads come mighty close to being the answer to a production engineer's prayer for a steady, day-in, day-out flow of threaded pieces into the pan.

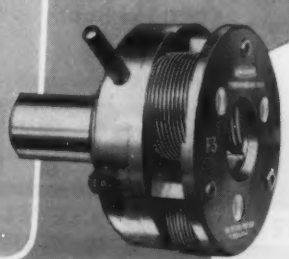
And when you consider that these thread rolling heads give you *better* threads—with smoother, more wear resistant surfaces, and with no cratering at the crest—aren't you missing a bet if *you* don't put them to the test on your threading jobs?

Wherever the work calls for threading machined parts from the end, there's no faster, better way than to "roll-em-on" with a National Acme (Fette) self opening head.

We'll be glad (and we think you will be too) if you ask us to prove that statement. Send sample or blueprint for our recommendation—or ask our representative to call.

May we send you a copy of Catalog FRH-53A ?

National Acme (Fette) Thread Rolling Heads are used on automatics, turret or hand lathes, threading machines, drill presses — and other types of vertical or horizontal machines. Basically, they are SELF-OPENING heads which operate like a die head, except that threading rolls are used instead of chasers. And they OPERATE AT HIGH-SPEED-STEEL TURNING TOOL SPEEDS. Made in Revolving Type (capacities 7/16" to 1") and in Non-revolving Type (capacities 1/16" to 3/4").



The NATIONAL ACME COMPANY

179 EAST 131st STREET • CLEVELAND 8, OHIO.

"It costs Less to DO IT RIGHT . . . . . than to DO IT OVER"

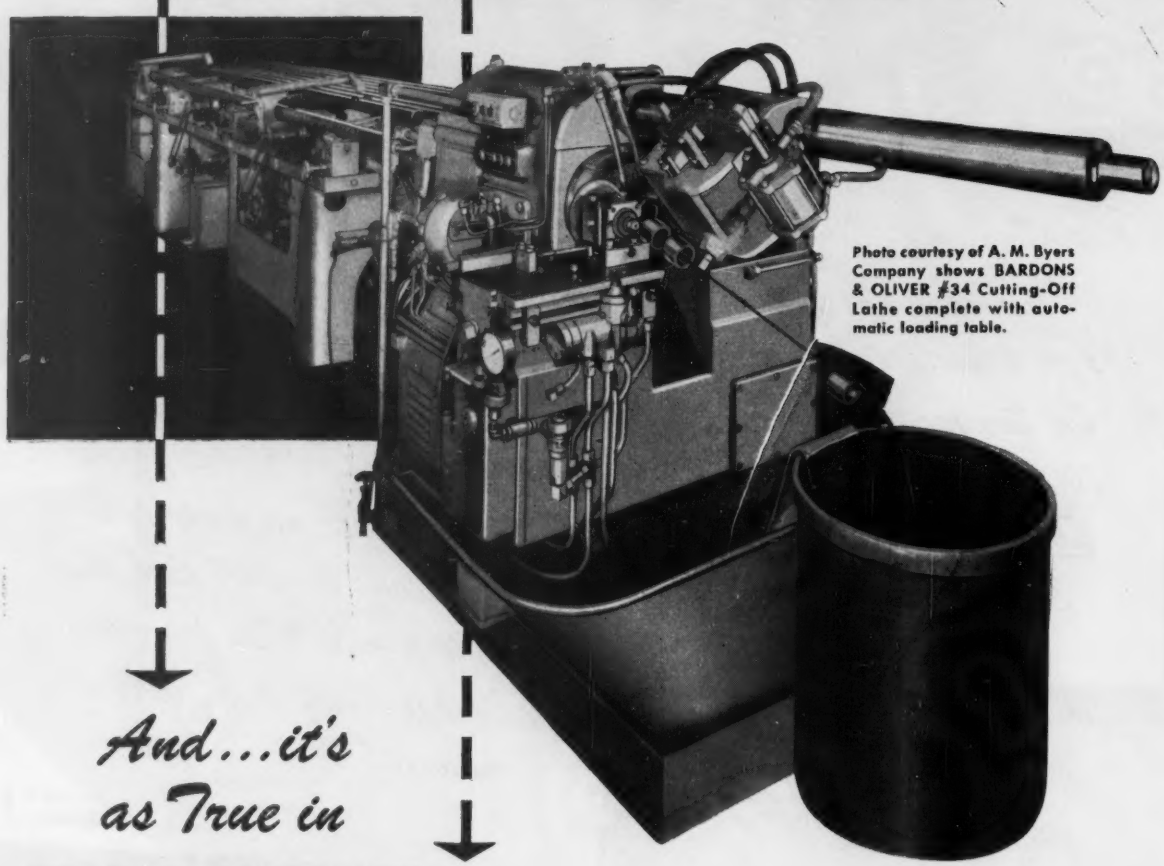


Photo courtesy of A. M. Byers Company shows BARDONS & OLIVER #34 Cutting-Off Lathe complete with automatic loading table.

And . . . it's as True in

BYERS

WROUGHT IRON PIPE

as it is with

BARDONS & OLIVER CUT-OFF LATHES

"It costs less to *do it right* . . . than to *do it over*" is the famous slogan of A. M. BYERS COMPANY, America's oldest and largest manufacturers of wrought iron pipe and tubular products . . . and they *practice what they preach* in the selection of BARDONS & OLIVER Cutting-Off Lathes. The folks at Byers are well aware of the advantages in buying *QUALITY* machines for lasting service. The quality built into every BARDONS & OLIVER Cutting-Off Lathe means years of accurate, dependable operation with peak production, and . . . speaking of peak production, the A. M. Byers Company is cutting-off and chamfering 1¼" Wrought Iron Pipe Coupling Blanks at the rate of 900 per hour . . . a real production bonus.

BARDONS & OLIVER, INC.

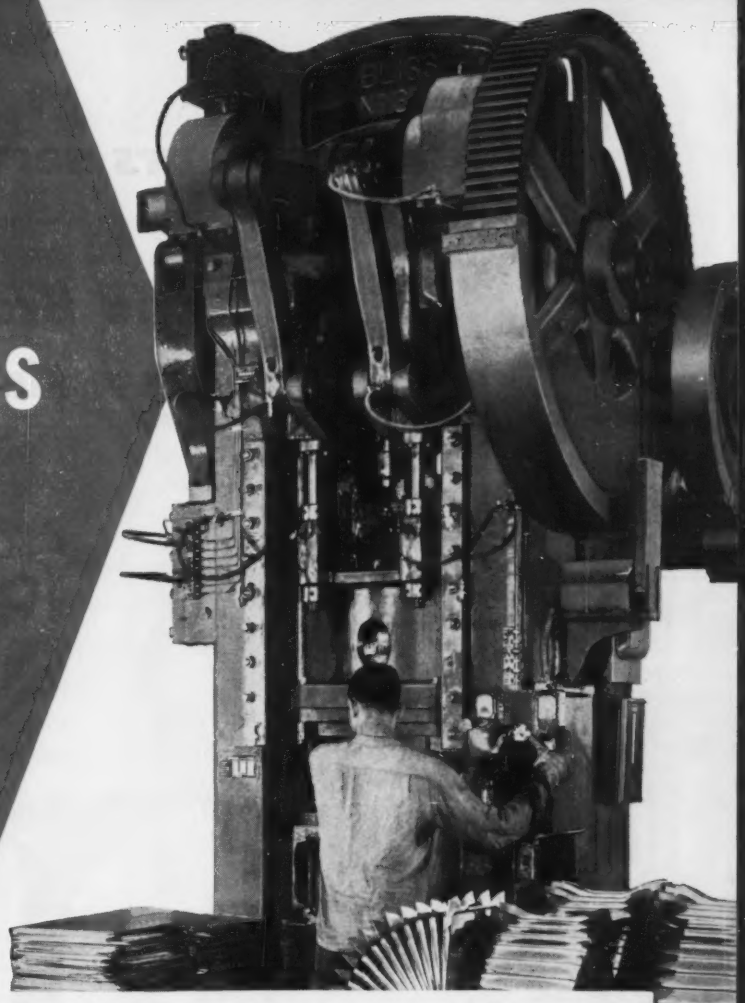
1135 WEST 9TH STREET • CLEVELAND 13, OHIO

For more information on products advertised, use Inquiry Card, page 255

95% of our presses are BLISS

that's why we're "quick on the draw" at BROIL-QUIK

Broil-Quik's famous Super Chef.



Bliss 3¾ Toggle press cuts and deep draws (to 2 1/16") 1600 Broil-Quik side panels per shift from 0.028" cold rolled steel blanks.

"In our fiercely competitive business, we have to have speed, dependability and little or no downtime," says John Simone, Superintendent. "With Bliss, we get it ... and more to spare. *That's why 95% of our presses are Bliss.*"

After consulting with Bliss engineers, Peerless Electric, Inc., New York, N. Y., makers of Broil-Quik rotisseries, chose the *right* presses for the jobs at hand—

- Bliss 28½ Inclinables—with their adaptability, rugged gap-frame construction and fast, dependable clutch operation—to draw and pinch off steel and aluminum blanks from 0.025" to 0.080" thick.
- And a Bliss 3¾ Toggle Draw press—with powerful blankholding pressure and rugged frame—to deep draw cold rolled steel blanks 0.028" thick.

Like Peerless, thousands of pressrooms are predominantly Bliss. For the fact of the matter is this: there are more Bliss presses in use today than any other make.

Chief among the reasons for this century-old standing is (1) Bliss makes more types and sizes of presses than any other builder; (2) Bliss "grinds no axe" for any one type. As a result you can be sure of impartial counsel from a Bliss engineer—you can count on him to help you pick the *one* right press for the job. Next time, do as thousands do, call Bliss first.

BLISS
SINCE 1857

is more than a name . . . it's a guarantee

E. W. BLISS COMPANY
CANTON, OHIO
PRESSES, ROLLING MILLS, SPECIAL MACHINERY

Subsidiary: The Die Supply Company, Cleveland, Ohio
E. W. Bliss (England) Ltd., Derby • E. W. Bliss Company (Paris) France

U. S. Plants in Canton, Salem and Toledo, Ohio; Hastings, Michigan; and San Jose, California. *Branch Offices* in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. *Other representatives throughout the world.*

Seven years service for STANOIL Industrial Oil at David Bradley Mfg. Works —No down time for lubrication

L. R. Cummings (left), Standard lubrication specialist, inspects sample of STANOIL, with Robert C. Menken, Plant Engineer of David Bradley Manufacturing Works. Larry Cummings has been serving industrial customers for Standard Oil since graduation from Standard's Sales Engineering School. His mechanical engineering degree from Tri-State College of Indiana qualified him for this work. Customers of Larry's find this experience and background pay off for them.

David Bradley Tri-Trac, handy piece of farm equipment, gives farmer new opportunity for mechanization at low cost. Upper frame on which gasoline tank is mounted, is part formed in HPM press.

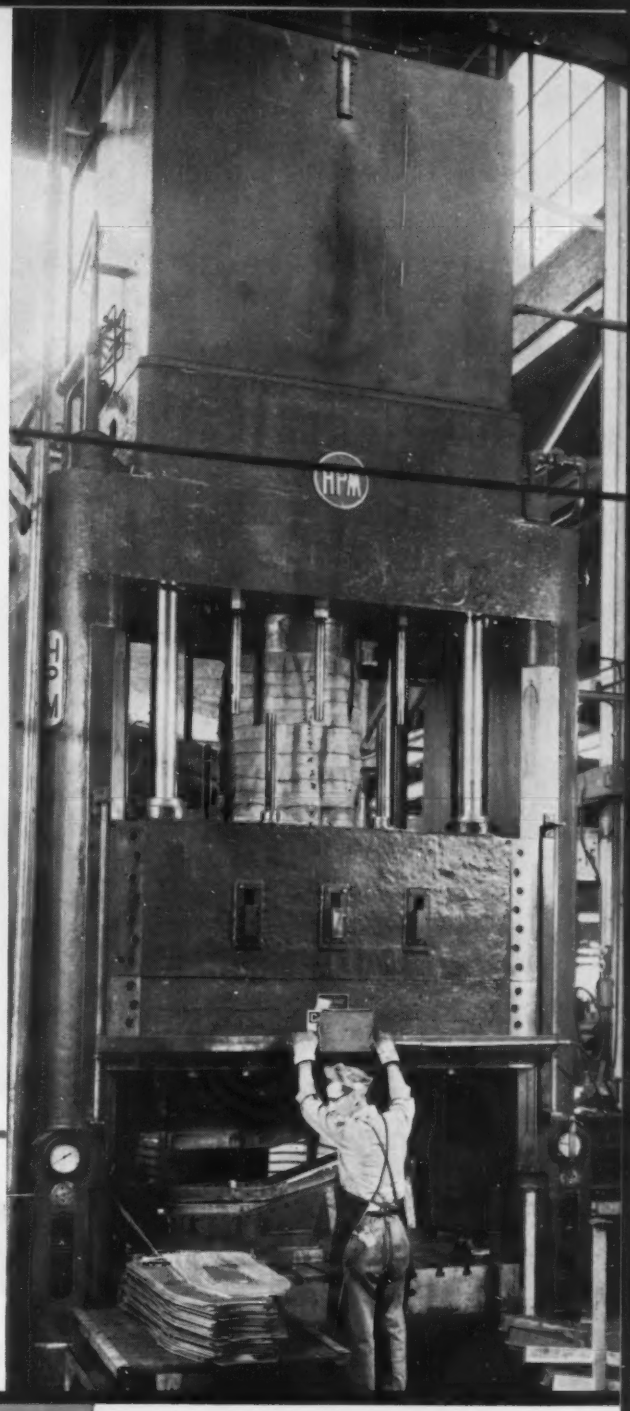
Seven years ago, David Bradley Mfg. Works installed 900 gallons of STANOIL Industrial Oil in an HPM press. There's been no down time required for lubrication maintenance since. A pump by-pass screen filter is the only filtering the oil receives, yet the system continues clean. In March, 1954, an analysis of the oil showed:

Viscosity @ 100°F.—980
Color, NPA — 6
Neutralization No.— .11

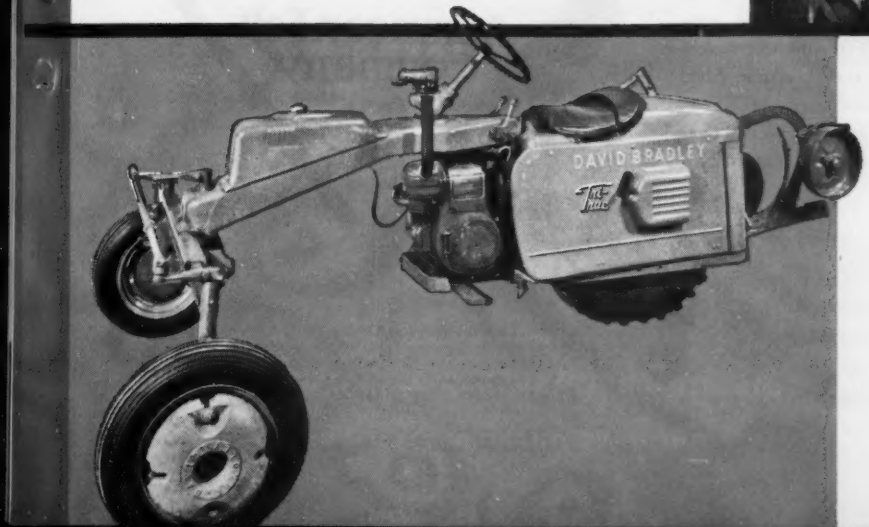
STANOIL Industrial Oil has long been at work for Bradley. Successful operations with it in other equipment caused Bradley engineers to specify STANOIL for this installation.

The HPM double acting, fast traverse hydraulic press reported on here is used to draw the upper frames for the David Bradley Tri-Trac, compact farm tractor. The Tri-Trac is the newest implement in the Bradley line. Bradley has been making farm implements since 1832.

Like to know more about STANOIL? Perhaps it can serve you as efficiently as it is serving David Bradley. Lubrication specialists in any Standard Oil office will be happy to help. In the midwest, a call to one of them will bring a prompt response. Or contact: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.



HPM 500-ton press on the upstroke after drawing upper frame for David Bradley Tri-Trac. Hydraulic system remains clean after 7 years service using STANOIL.



STANDARD

STANDARD OIL COMPANY
(Indiana)

design with QUALITY felt in mind!

Gaskets, washers, wick lubricators are just a few applications of felt. Felt reduces vibration, controls noise, seals oil in, water out. American makes many types of felt, in rolls, sheets, and in parts cut to your blueprints, ready for assembly. Tell us what you make, or are designing, and we will send technical information along with our suggestions.

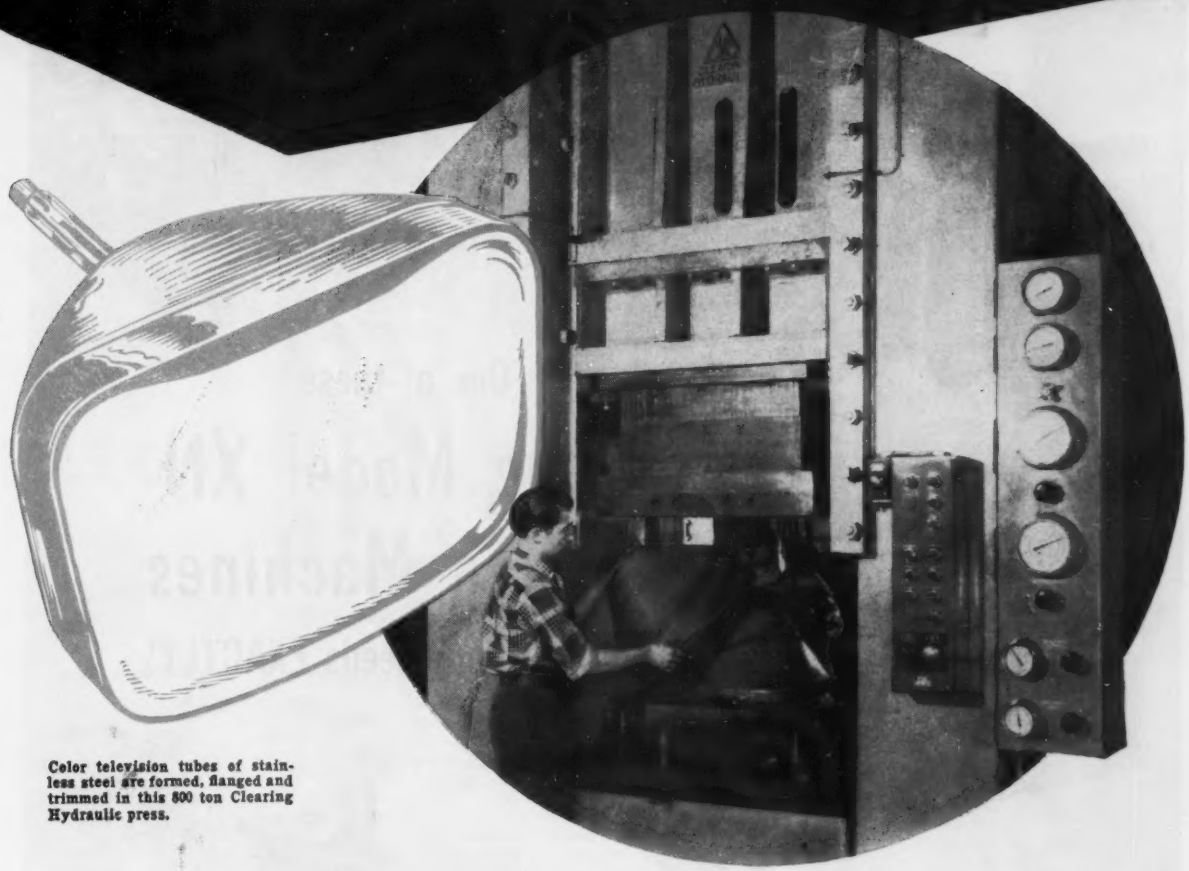
American Felt Company
TRADE MARK ®

FREE! *Catalog containing 47 samples of felts plus 24-page booklet of Wool Felt Standards. Write for Catalog 185-52.*

GENERAL OFFICES: 68 GLENVILLE ROAD, GLENVILLE, CONN.
SALES OFFICES: New York, Boston, Chicago, Detroit, Cleveland, Rochester, Philadelphia, St. Louis, Atlanta, Dallas, San Francisco, Los Angeles, Portland, Seattle, Montreal. PLANTS: Glenville, Conn.; Franklin, Mass.; Newburgh, N. Y.; Detroit, Mich.; Westerly, R. I.
ENGINEERING AND RESEARCH LABORATORIES: Glenville, Conn.

For more information on products advertised, use Inquiry Card, page 255

T.V. color tubes of stainless steel



Color television tubes of stainless steel are formed, flanged and trimmed in this 800 ton Clearing Hydraulic press.

mass produced on a CLEARING Hydraulic

Full 24" tubes made of stainless steel will put color television on the market with a big 21" picture right from the start. United Specialties Co., Chicago, in cooperation with a large set manufacturer, designed a steel shell to meet color requirements.

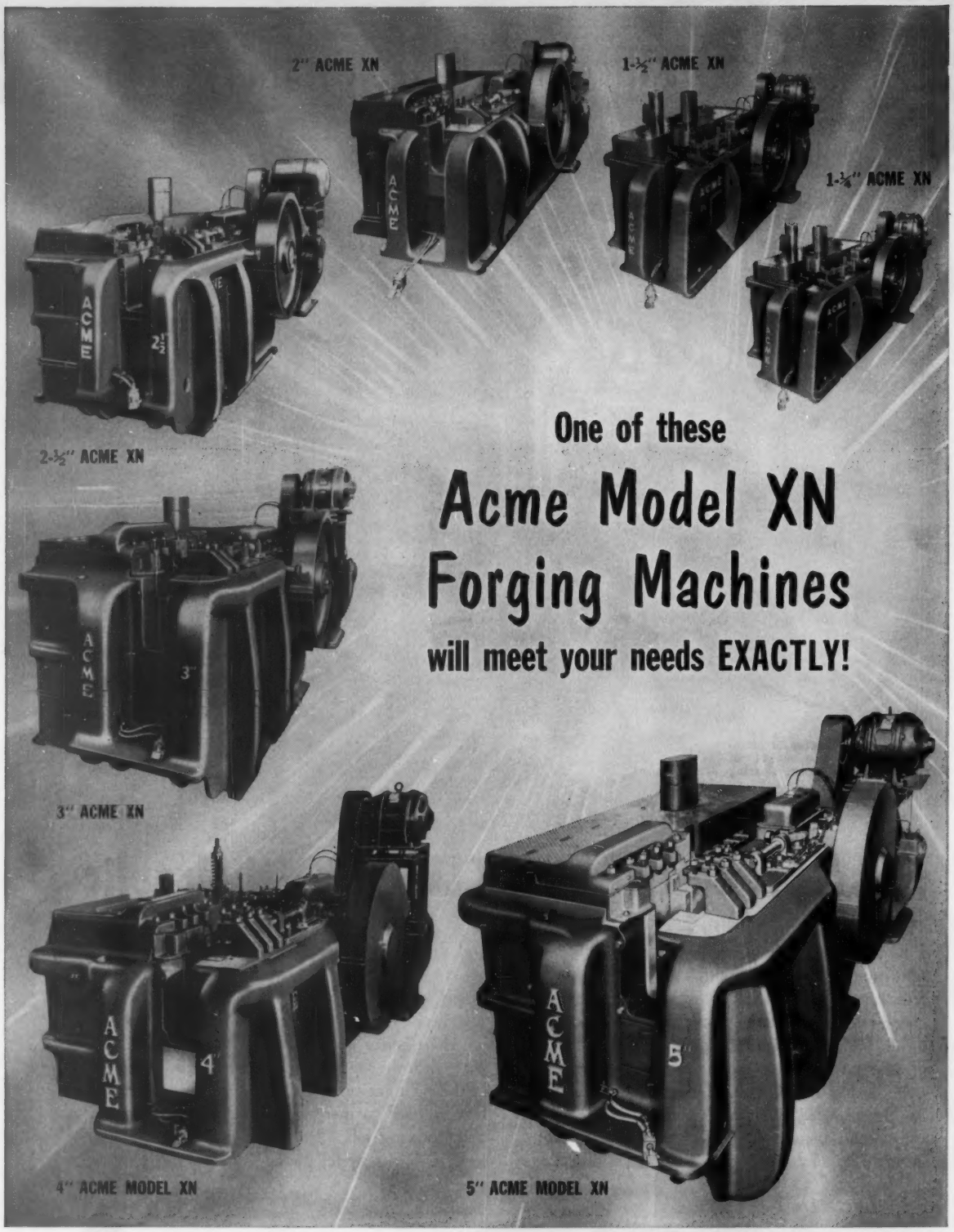
Metal tubes have many important advantages over glass in the opinion of United Specialties. They can be produced much faster with fewer rejects and they are far easier and safer to handle in production. A metal tube has fewer potential sources of leakage and finished weight is less than half of that of a glass tube, lowering shipping, mounting and assembly costs.

These tubes are another important example of a job done better and faster by press metalforming. The Clearing 800 ton hydraulic has proved itself to be the right answer to United's production problem. If you want to increase volume or tackle a new metalforming job, Clearing engineers are at your service. Write or telephone Clearing today.

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION *DIVISION OF U. S. INDUSTRIES, INC.*

6499 WEST 65th STREET, CHICAGO 38, ILLINOIS · HAMILTON PLANT, HAMILTON, OHIO

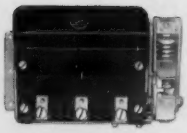


THE HILL ACME COMPANY

ACME MACHINERY DIVISION • **1203 W. 65th St., Cleveland 2, Ohio**
ESTABLISHED 1882

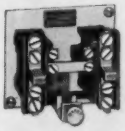
"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

For more information on products advertised, use Inquiry Card, page 255

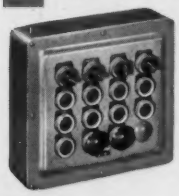


1 **Manual Disconnect** with cabinet door handle safety interlock.

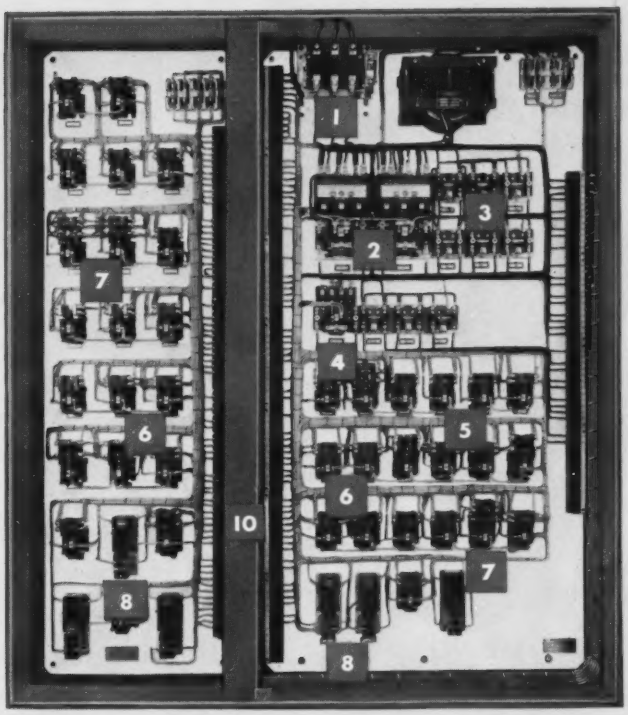
2 **Large Solenoid Starter** with overload relays.



3 **Overload Relays**



11 **Master Station**



10 Automatic Control Panel for Hoern & Dilts boring machine shown below.

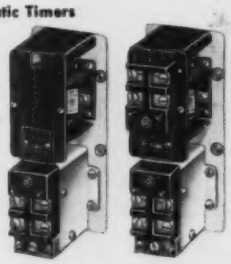
Oiltight Push Buttons **9**

With mushroom head push button and oiltight diaphragm for oily locations.

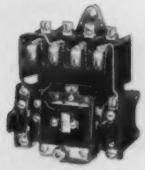
With selector for 3-way Automatic-Off-Hand control.

8 **Pneumatic Timers**

Easily adjustable from 1/6 second to 3 minutes. Available in a large variety of On-Delay or Off-Delay contact combinations. Also listed for direct current.



4 **Small Size 1 Solenoid Starter**



Complete line includes 8 sizes—from Sizes 0 to 7.

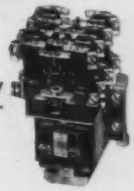
5 **Four-pole Relay**

In any combination of normally open or normally closed contacts.

6 **Universal Relay**

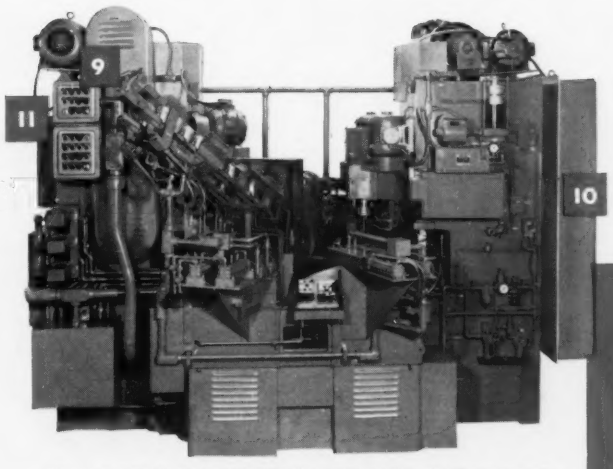
Has normally open and normally closed contacts. Merely change connections.

7 **Eight-pole Relay**



8-Pole relay with 4 N.O. contacts.

HOW TO BUILD TROUBLE-FREE MOTOR CONTROL PANELS



Hoern & Dilts Model BH-16-35 Indexing Type Precision Turning and Boring Machine equipped with A-B controls and oiltight push buttons.

Special control panels are commonly used with modern production machines. They are the "brains" of the machine—they must be dependable. Therefore, they must be assembled with trouble-free components . . . like the Allen-Bradley starters, relays, timers, and control stations shown on this page. The Allen-Bradley reputation for QUALITY is your assurance of trouble-free operation.

Send for the latest edition of the 120-page Allen-Bradley Handy Catalog . . . it's a veritable handbook of modern automatic and manual motor controls. Write, today.

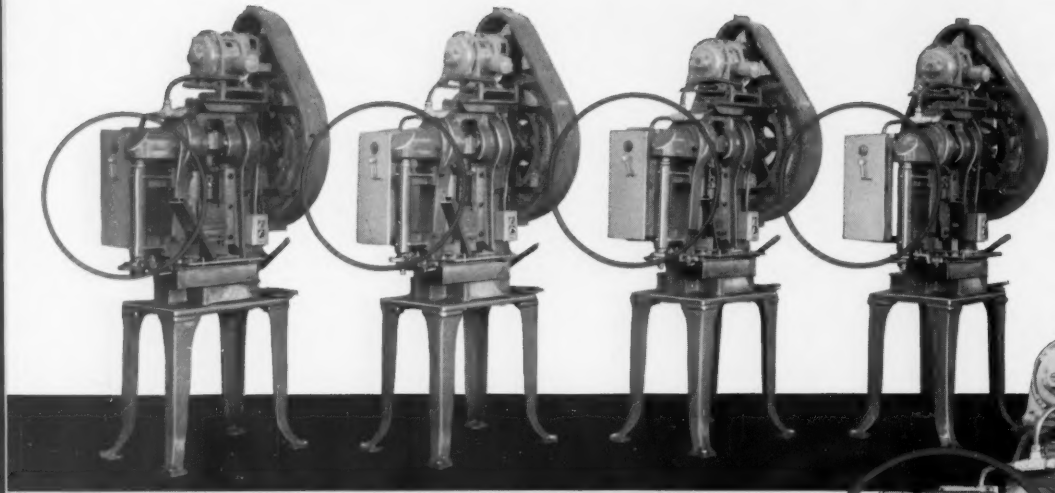
Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.

In Canada—
Allen-Bradley Canada Ltd.
Galt, Ontario

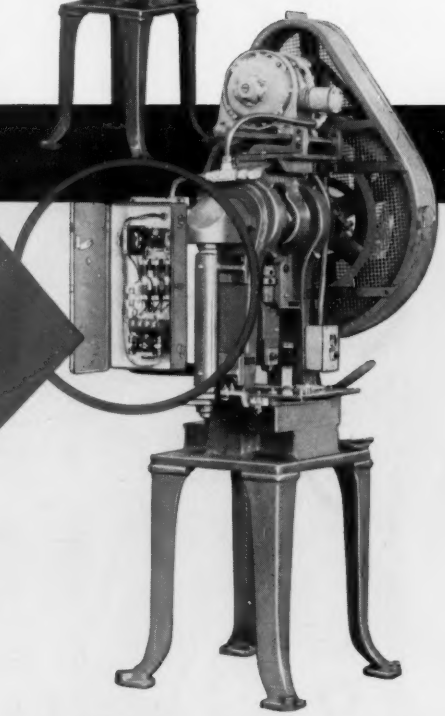
A-B

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

1-53-R

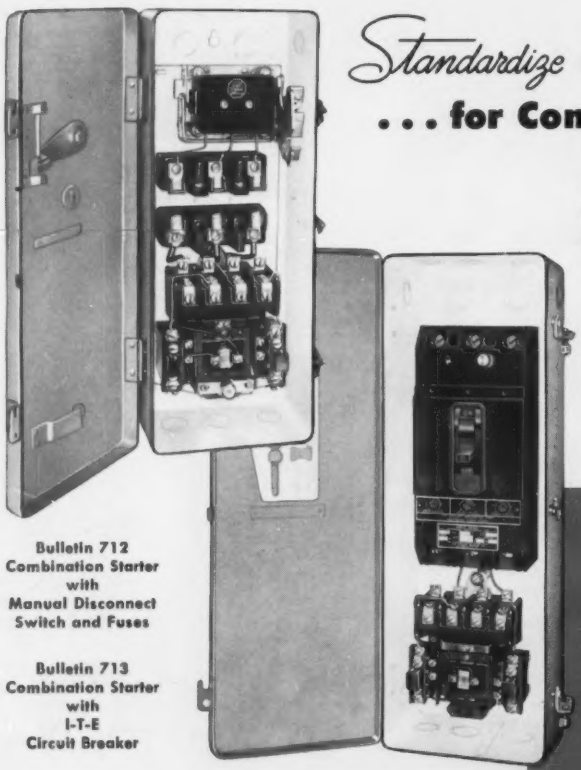


Waterbury Farrel Stamping Presses equipped with A-B Combination Starters.



DISCONNECT SWITCH — FUSES — SOLENOID STARTER
. . . all combined in ONE ENCLOSURE . . .

Alert machinery manufacturers recognize the sales advantage of equipping their motor-driven machines with these compact combination starters. They combine disconnect switch, fuses, and solenoid starter in a single enclosure . . . and they provide this added safety feature . . . it is impossible to open the starter cabinet until the disconnect lever is moved into the OFF position. The combination starter provides a clean, finished appearance—a sales asset for any machine tool. And—the installation cost is less!



Bulletin 712 Combination Starter with Manual Disconnect Switch and Fuses

Bulletin 713 Combination Starter with I-T-E Circuit Breaker

Standardize on A-B COMBINATION STARTERS . . . for Compact and Safe Motor Control

Allen-Bradley combination starters come in two general types—Bulletin 712 with a manually operated disconnect unit (with or without fuse clips)—and Bulletin 713 with an I-T-E instantaneous circuit breaker.

See the neat, compact starter installations on the machines, above. Streamline your machines to give them a "New Look" with Allen-Bradley combination starters. Write, today, for the A-B 120-page Handy Catalog.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

In Canada—Allen-Bradley Canada Limited, Galt, Ont.

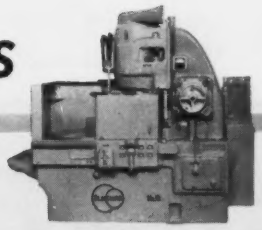
ALLEN-BRADLEY

BULLETIN QUALITY 712-713

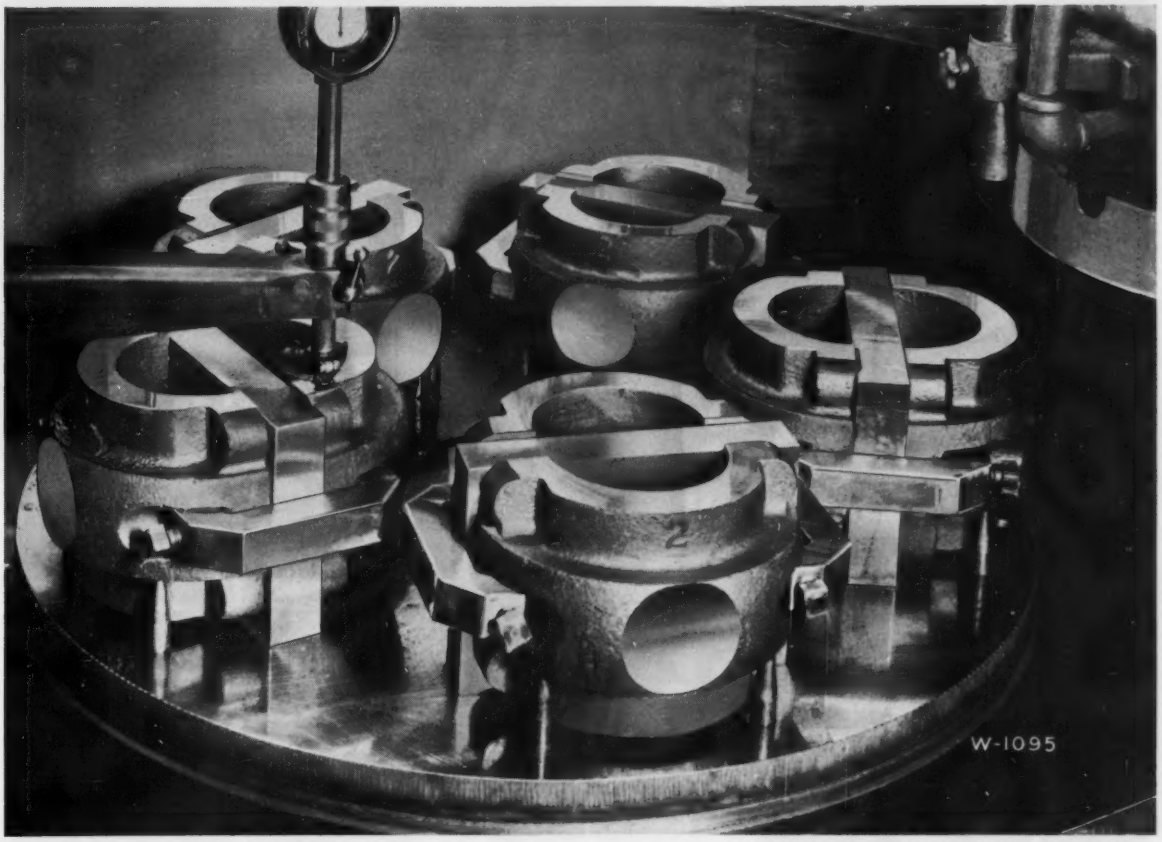
COMBINATION STARTERS

1-55-R

IT PAYS



TO PUT IT ON A BLANCHARD



The first operation on these cast steel (1504) bearings is to Blanchard grind the parting line to establish locating surfaces.

Then, a No. 18 Blanchard Surface Grinder (shown above), with 36" magnetic chuck, rough grinds the end faces of all five sets in 17 minutes—at an abrasive cost of only 2¢ per piece! This operation provides locating surfaces for additional machining. By using the correct Blanchard wheel* and proper rate of down feed, the wheel dresses itself and removes three cubic inches of cast steel per minute.

The final Blanchard operations include finish grinding both end faces—removing .015" of stock from each end, flat and parallel to ±.001". Each surface is ground in 17 seconds, fourteen pieces to a load, located directly on the magnetic chuck.

**Blanchard Grinders perform best with Blanchard Wheels!*

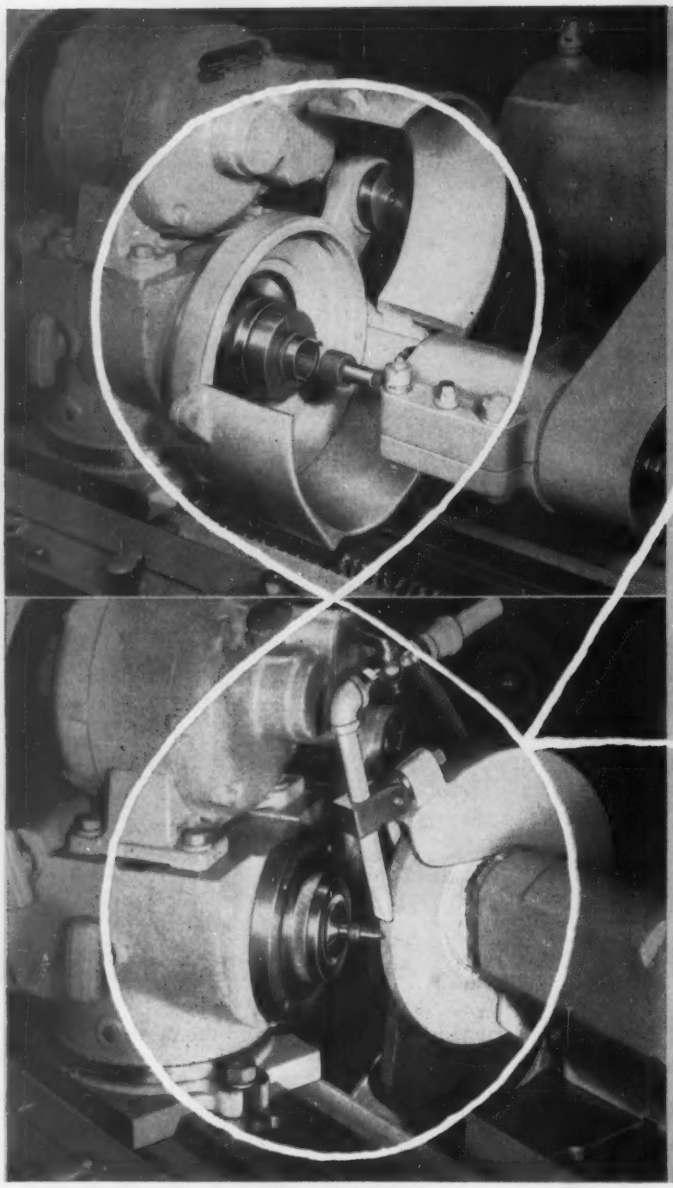
Send for your free copies of "Work Done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

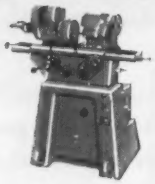
For more information on products advertised, use Inquiry Card, page 255



RIVETT

MODEL 84

INTERNAL-EXTERNAL GRINDER



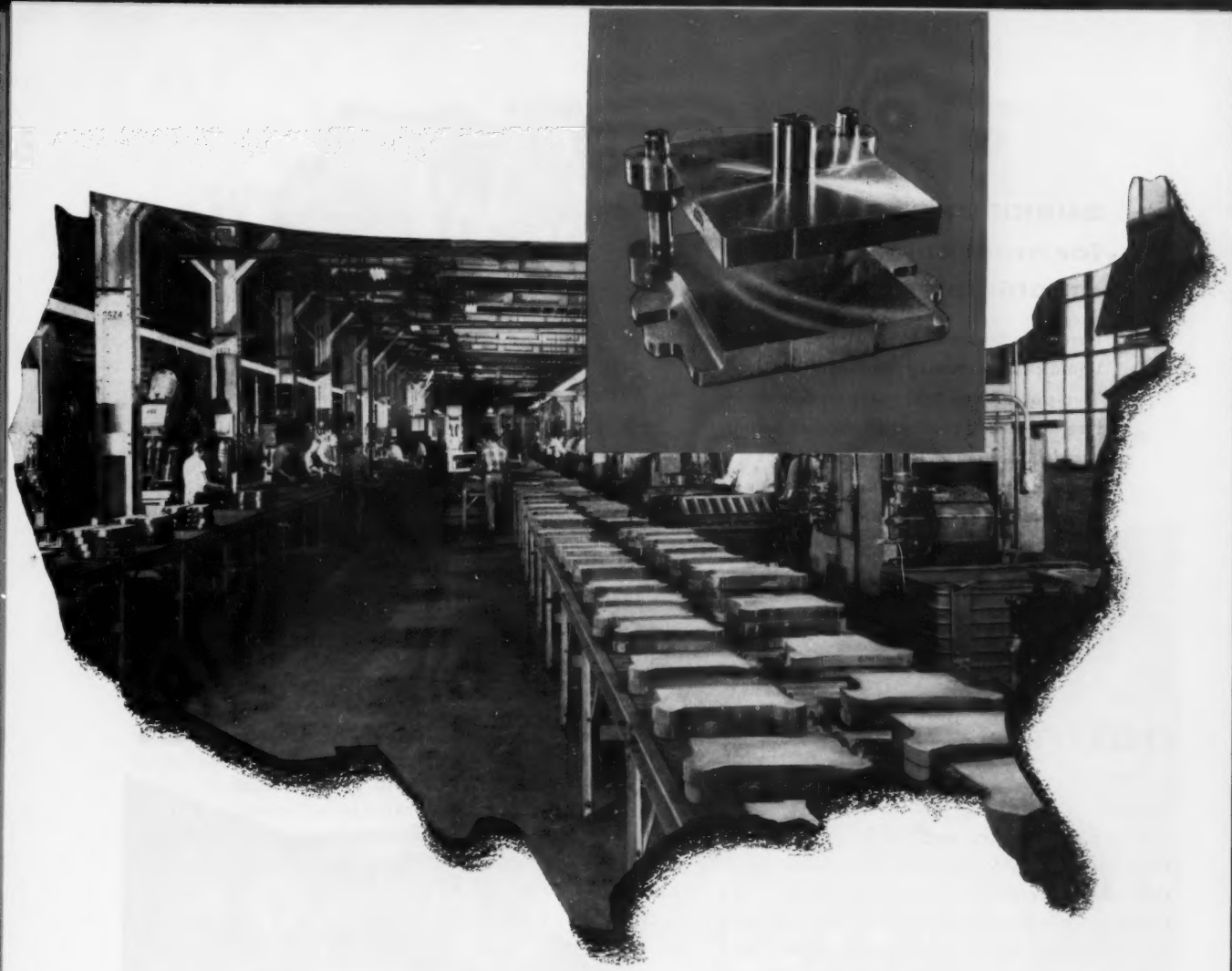
This small hole grinder mounts interchangeable wheelheads for internal and external spindles. Hole capacity is 3" dia. with a maximum depth of 4"; external is to 3" dia. by a 4" length. Collets and step chucks mount directly in lathe-type spindle.

This flexibility combined with the inherent accuracy is why the Rivett 84 has gained great popularity in toolrooms since its introduction to the trade twelve months ago.

Quick and easy to set up, the 84 will handle your diversified jobs faster, too. All the details to prove this are shown in Catalog No. 84-A. **Write for a copy today!**

RIVETT LATHE & GRINDER, INC., DEPT. MR-1, BRIGHTON 35, BOSTON, MASS.

For more information on products advertised, use Inquiry Card, page 255



Here's the "how" of the fastest Die Set Service ever

FIRST, Danly is able to apply mass-production efficiency in manufacturing high precision, *interchangeable* die set components to the traditional Danly quality standards. **SECOND,** each Danly Branch is stocked with thousands of these *interchangeable* die set components, for immediate assembly to meet your tooling requirements. **THIRD,** Danly Branches are strategically located throughout the United States in major toolmaking centers to give you quick, local delivery. So, when you want the finest die sets in the shortest time . . . just call your nearby Danly Branch.

Which Danly Branch is closest to you?

BUFFALO 7	1807 Elmwood Avenue
CHICAGO 50	2100 S. Laramie Avenue
CLEVELAND 14	1550 East 33rd Street
DAYTON 7	3196 Delphos Avenue
DETROIT 16	1549 Temple Avenue
GRAND RAPIDS	113 Michigan Street, N.W.
INDIANAPOLIS 4	5 West 10th Street
LONG ISLAND CITY 1	47-28 37th Street
LOS ANGELES 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 E. Wisconsin Avenue
PHILADELPHIA 40	511 W. Courtland Street
ROCHESTER 6	33 Rutter Street
ST. LOUIS 8, Mo.	3740 Washington Blvd.
SYRACUSE 4	2005 West Genesee Street

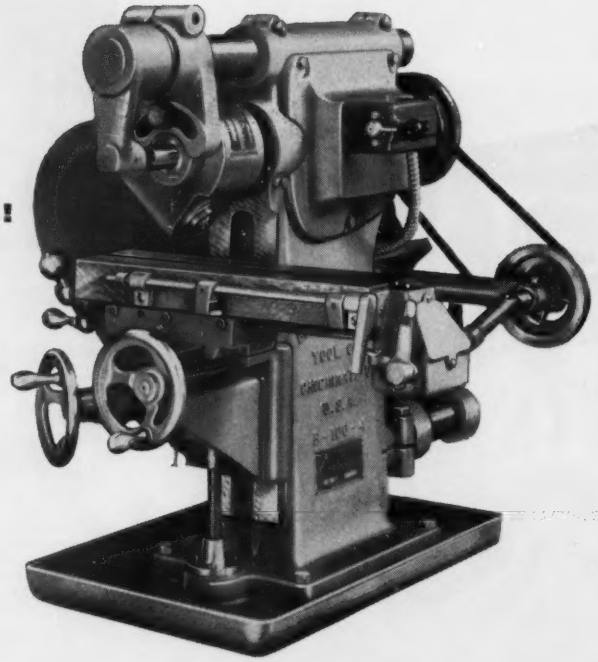
DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Ill.

DANLY®

DIE SETS . . .
STANDARD OR SPECIAL
DIEMAKERS' SUPPLIES

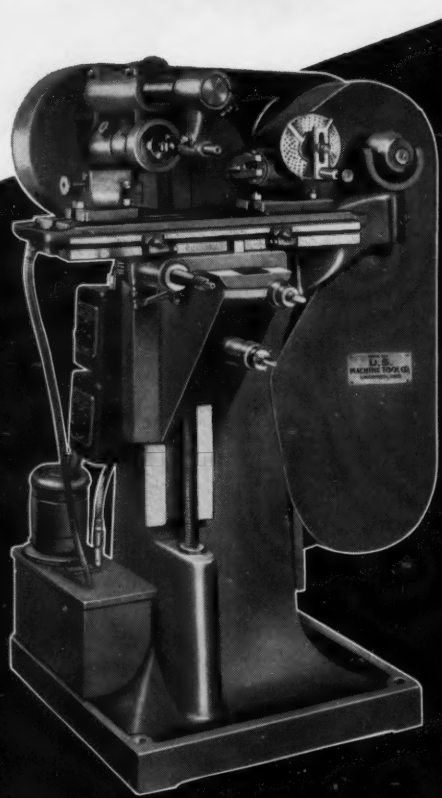
BURKE BENCH MILLERS
. . . for most efficient machining of small parts!

Here's the horizontal miller that combines unmatched accuracy and low cost! Two power feed tool room models and two hand feed production models permit rapid handling of a wide variety of small parts and freeing big millers for larger jobs. Numerous attachments and accessories provide even greater versatility and speed. Detailed literature on request.



OUTSTANDING ACCURACY AT LOWEST COST

Find out how fast, accurate and economical small milling *can be!* U. S. Burke milling machines provide outstanding quality, dependability and convenience in operation . . . for hundreds of dollars less than leading competitors. Investigate U. S. Burke time and money-saving performance now! Write
The U. S. Burke Machine Tool Division,
17 Brotherton Road,
Cincinnati 27, Ohio



U.S. No. 1 HAND MILLING MACHINE
. . . half the cost, twice the value!

A top-quality precision production tool . . . priced so low it's actually profitable to spot it around "looking for work" that can be kept out of the milling section. Accurate, rigid, simple and adaptable. Easily equipped with air-hydraulic feeds for high production. Detailed literature on request.

THE U·S·Burke MACHINE TOOL DIVISION

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Why the builder of this plate shear installed a Farval system

FARVAL
Studies in Centralized Lubrication
No. 154

ONE tiny bearing starved for lubrication could shut down this giant 1¼" x 180" plate shear, towering above the men who built it. The builder avoided this hazard by installing a modern centralized lubrication system—Farval. In fact, Farval is standard on most Stamco equipment.

The experience of builders and users alike shows that machines lubricated by Farval run longer and at higher speeds without fear of lubrication troubles. Bearing life increases. Maintenance costs drop. Farval saves 45 minutes out of every hour required to lubricate by hand, saves up to 75% of lubricant consumed by other methods.

How Farval works

Farval is the Dualine system of centralized lubrication that hydraulically delivers oil or grease, exactly measured, to each individual bearing, as often as desired. No bearings are ever missed, no matter where located.

Machinery builders prefer Farval because the Farval valve is simple and sure with wide ports, engineered to deliver the *exact* amount of lubricant required. Indicators at every bearing show *positive proof* that each valve has functioned.

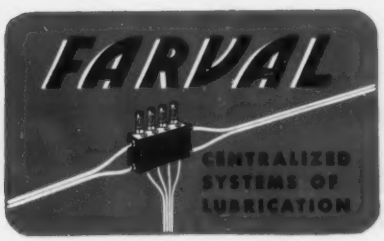
Farval helps plant efficiency

Farval on any piece of equipment gives you a measurable advantage for the competitive years ahead! Write for free Bulletin 26. The Farval Corporation, 3276 East 80th St., Cleveland 4, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.

KEYS TO ADEQUATE LUBRICATION—Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

In the photo above, you see the 13 men who built this giant *Farvalized* plate shear. Photo courtesy of Stamco Inc.



Don't Let Small Parts Clutter Up Your BROACHING OPERATIONS

OIL GROOVES
SMALL SPLINES
SERRATIONS
KEYWAYS
SLOTTING
BURRING
SIZING HOLES

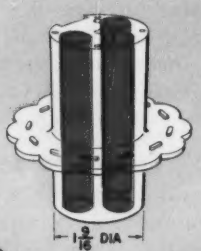
These can all be broached AT FAR LESS COST on Red Ring Self-contained Broaching Fixtures. Use your standard broaching machines for the heavier jobs on which they pay off.

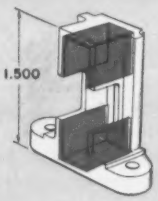
The Self-contained Fixture has its own pneumatic power unit to pull or push the broach. Just set it on a table, connect it to the air line and you are ready to start broaching. Or you may want to mount it vertically to further economize floor space.

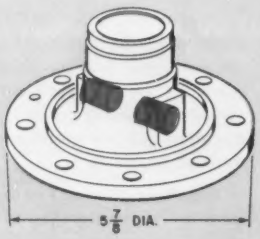
Like other fixtures or dies, these units may be stored in the tool room when not in use. They occupy little space and are easily portable.

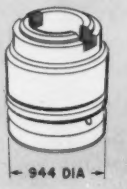
Application is practically unlimited for jobs requiring a "Pull" of 2,000 lbs. or less and a stroke not exceeding 25 inches.

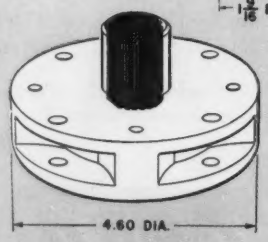
Call a Red Ring Broach Engineer or write for Bulletin B54-9 for more detailed information.











7018

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

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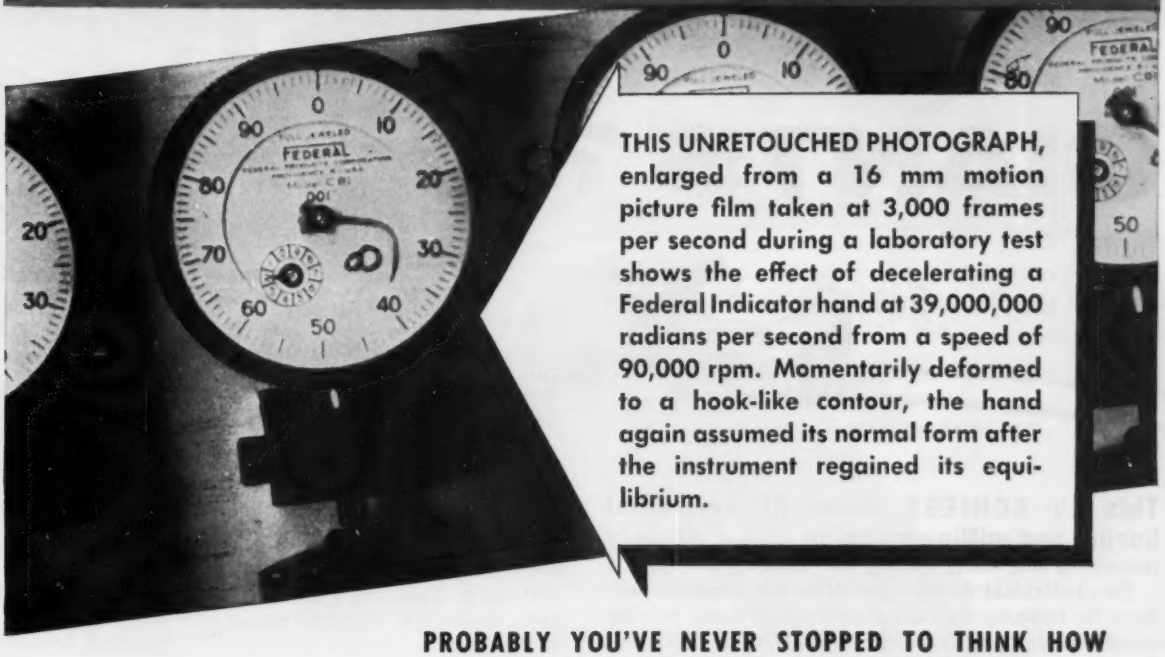
What this test means to YOU!


FEDERAL
THIS UNRETOUCHED PHOTOGRAPH, enlarged from a 16 mm motion picture film taken at 3,000 frames per second during a laboratory test shows the effect of decelerating a Federal Indicator hand at 39,000,000 radians per second from a speed of 90,000 rpm. Momentarily deformed to a hook-like contour, the hand again assumed its normal form after the instrument regained its equilibrium.

PROBABLY YOU'VE NEVER STOPPED TO THINK HOW IMPORTANT AN INDICATOR HAND CAN BE...

IT IS NOT JUST CONVENTIONAL MODERN DESIGN that makes the hand on a Federal Dial Indicator look as it does!

This high-speed movie shows one of thousands of tests made in our laboratory in a constant effort TO PRODUCE THE FINEST POSSIBLE DIAL INDICATORS FOR YOU. In this destructive test the hand has been momentarily deformed by an excessive blow on the Indicator's contact point.

You naturally ask why we don't just make a stiffer hand. The answer is that a *heavier* hand would increase the inertia and friction within the Indicator and decrease its sensitivity and accuracy. A *lighter* hand would have less inertia but it would not recover its normal straightness after extreme operating conditions. The hand of a Federal Dial Indicator MAINTAINS ITS NORMAL SHAPE.

Furthermore, the hand on a Federal Dial Indicator IS STATICALLY BALANCED to assure a CONSISTENT GAGING PRESSURE against the workpiece. You get a more sensitive Indicator of GREATER REPETITIVE ACCURACY.

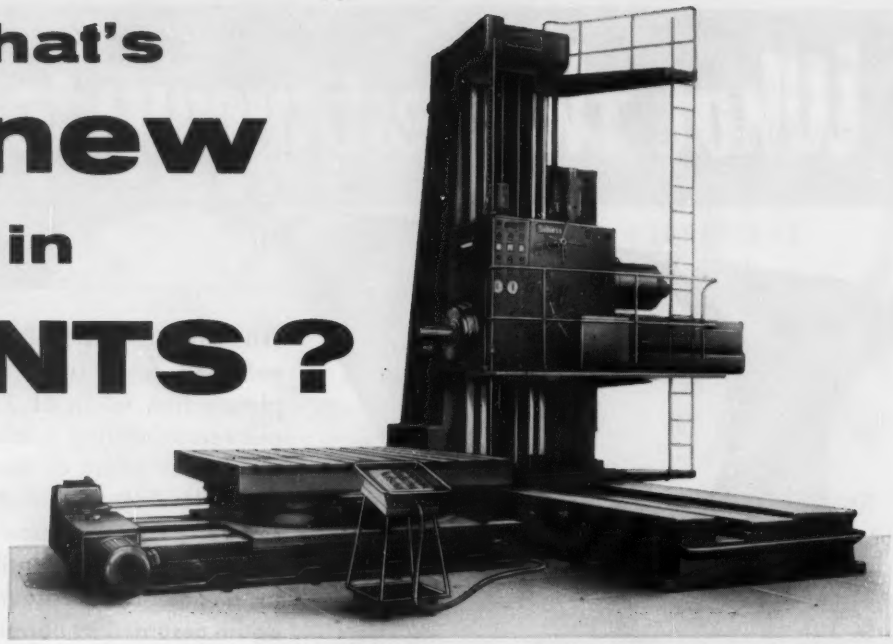
This kind of detailed research is typical of the great care that goes into the design and improvement of Federal Dial Indicators and helps to explain WHY FEDERAL IS THE WORLD'S LEADING MANUFACTURER OF DIAL INDICATORS.

It is also very much worth noting that modern manufacturing techniques and Modern Quality Control have enabled us to sell Federal Dial Indicators AT THE SAME LOW PRICE FOR FIFTEEN YEARS. If you haven't our latest catalog showing the most complete line of Dial Indicators of all styles and sizes, write Federal Products Corporation, 5111 Eddy St., Providence 1, R. I.

FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing *all types* of DIMENSIONAL *INDICATING* GAGES

what's new in GIANTS?



This 8⅛" SCHIESS model BF horizontal boring and milling machine . . . Now completely redesigned with many innovations. Here are a few . . .

Two individual drives—gear-drive for roughing, belt-drive for finishing. Belt-drive particularly suited to high-speed machining with carbide tools. New tool clamping device—does away with draw keys, hammers, drifts and binding screws. All spindle-slide movements controlled from easily accessible operating platform (or from pendant station or portable control panel, if desired). Special main-drive belt requires no readjusting. Column, spindle-slide and boring spindle may be adjusted at rapid traverse.

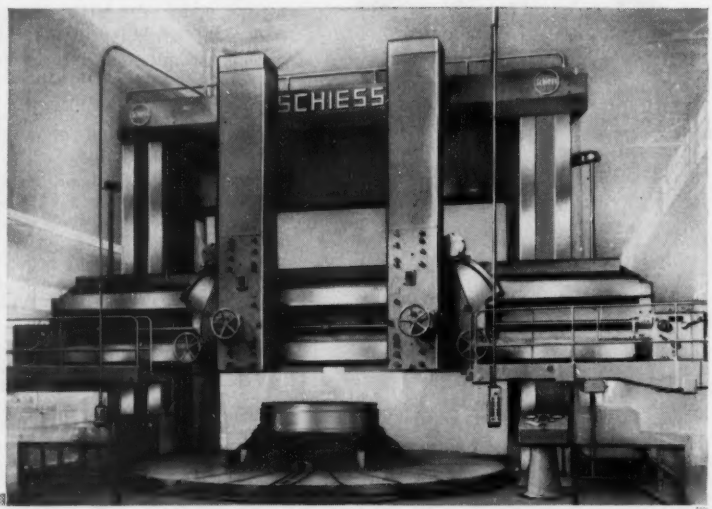
Spindle diameters, 6⅝" to 8⅞". Maximum diameter bored, 59"—faced, 79".

It takes Europe's largest builder of heavy machine tools, Schiess, to turn out giants like these. Parts and service as close as Pittsburgh. And an American Schiess engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on all Schiess BF and K models.

This 23 ft. SCHIESS model K vertical boring mill . . .

Look at all these new features—each one a time-saver! Rapid traverse motions with pushbutton control of changeover from feed motion to independent power traverse. Electro-mechanical locking of cross-rail to columns. Fingertip speed control—counterbalanced cross-rail and side-head—completely enclosed swiveling octagon rams—pendant control—automatic lubrication.

Turning diameters in standard sizes range from 8 ft. to 23 ft. (which can handle stock up to 100 tons!). Basic Schiess designs permit extra heavy machines, normally considered specials, to be built to your work diameter and load requirements. Even a diameter of 84 ft.!



Engineering Division
AMERICAN
SCHIESS
CORPORATION
38th Street and AVRR, Pittsburgh, Pennsylvania

Sole Distributor
KURT ORBAN COMPANY, INC.
34 Exchange Place, Jersey City, N. J.

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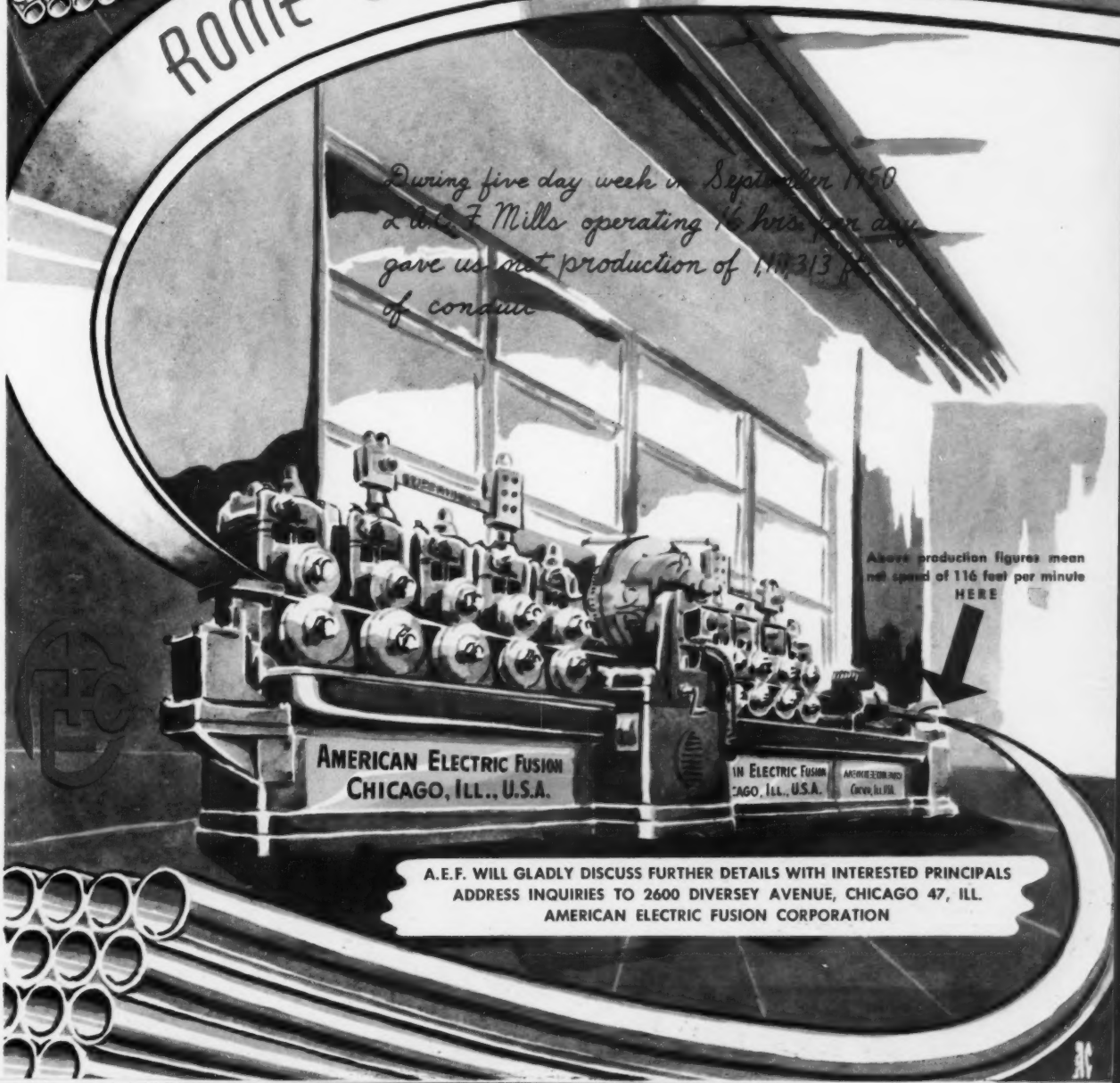
"Roll your own"

HYDRAULIC TESTER FOR CODE PIPING BEFORE SHIPMENT

ROME CABLE CORP. SAYS:

During five day week in September 1950 2 of our 7 Mills operating 16 hrs per day gave us net production of 1,111,313 ft of conduit



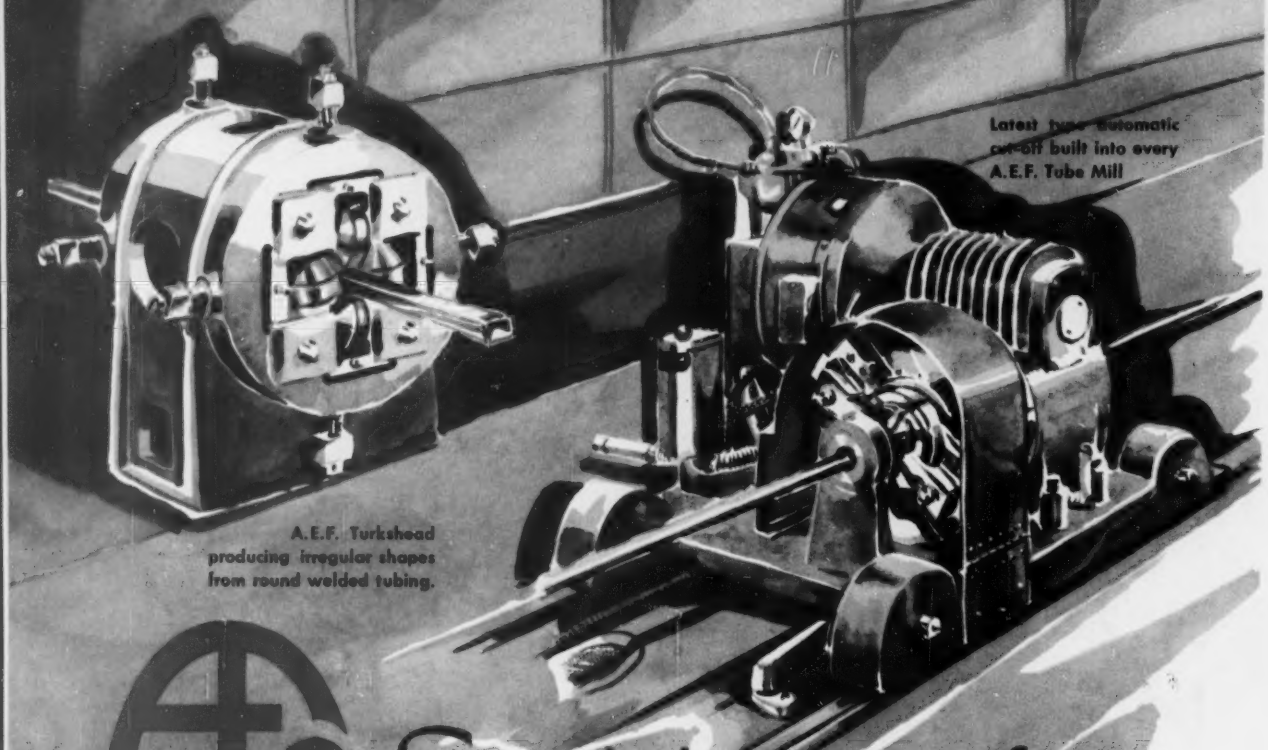
Above production figures mean net speed of 116 feet per minute HERE

A.E.F. WILL GLADLY DISCUSS FURTHER DETAILS WITH INTERESTED PRINCIPALS
ADDRESS INQUIRIES TO 2600 DIVERSEY AVENUE, CHICAGO 47, ILL.
AMERICAN ELECTRIC FUSION CORPORATION

AMERICAN ELECTRIC FUSION CORPORATION

2600 DIVERSEY AVENUE

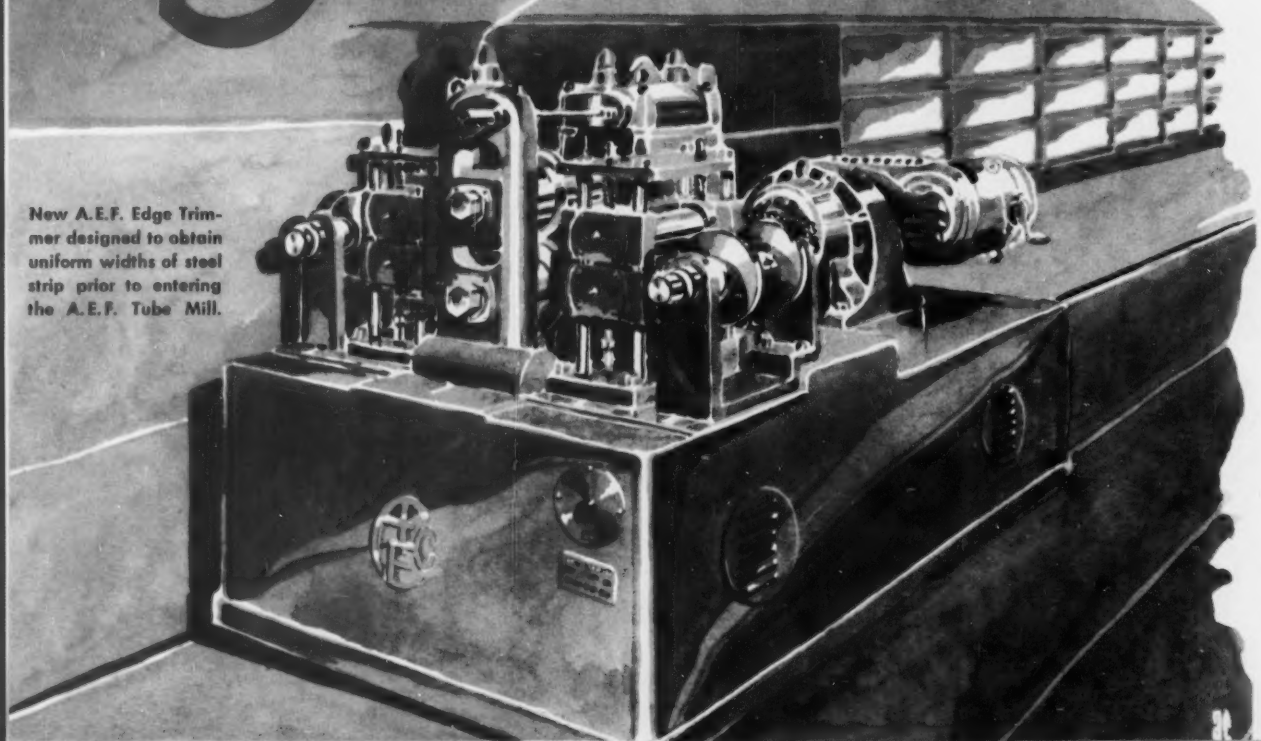
PHONE — BRUNSWICK 8-1640 CHICAGO 47, ILLINOIS



Latest type automatic cut-off built into every A.E.F. Tube Mill

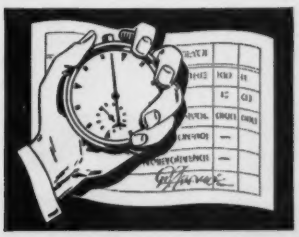
A.E.F. Turkshead producing irregular shapes from round welded tubing.

Sound design — first
Good appearance always



New A.E.F. Edge Trimmer designed to obtain uniform widths of steel strip prior to entering the A.E.F. Tube Mill.

Faster Shearing at Follansbee



The addition of a big Steelweld Pivoted-Blade Shear in the Pittsburgh warehouse of Follansbee Metals, a division of the Follansbee Steel Corporation has greatly speeded the plate service they provide.

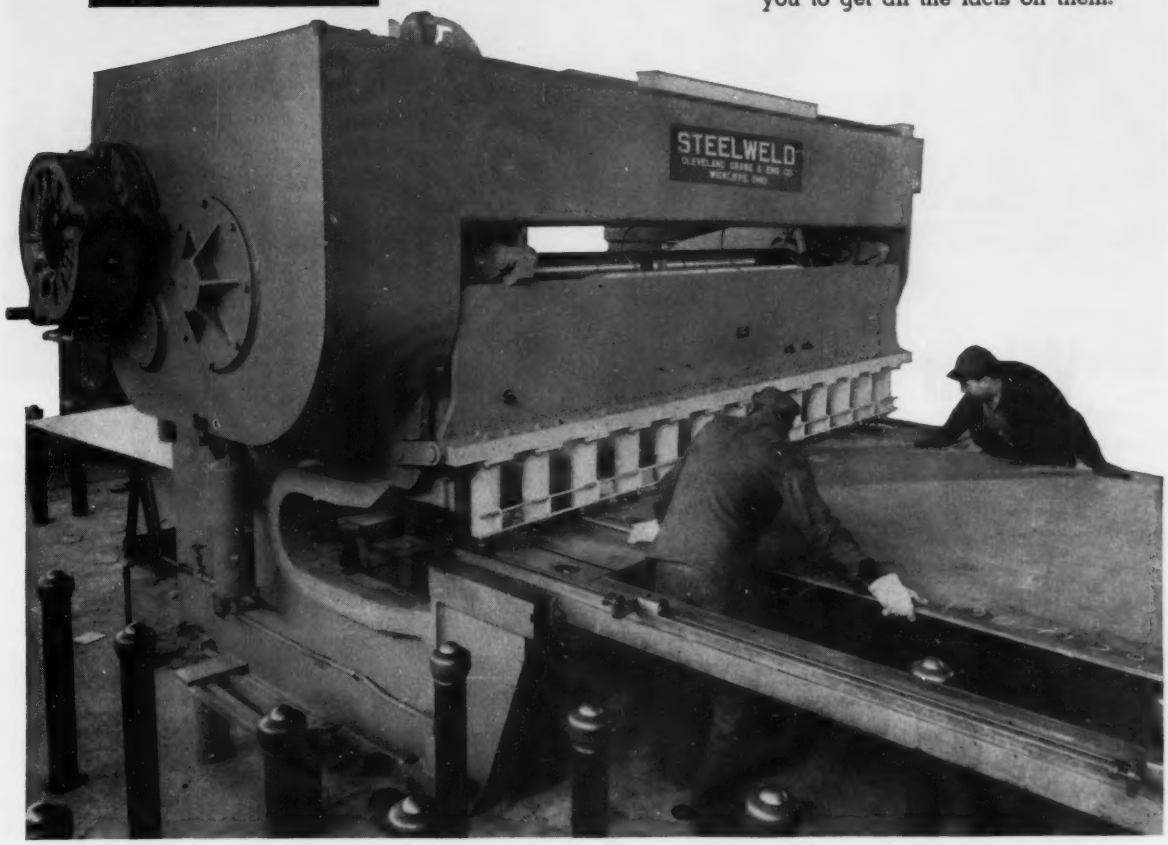
Hot rolled steel plates, stainless plates, floor plates and other metals are cut smoothly and accurately. The machine can handle mild steel up to 12'-0" x ¾". The 36" deep throat permits slitting plates 72" wide down the middle for any length.

Because of the Micro-Set knife adjustment, it is quick and easy to properly set the knife clearance to obtain the best possible cut for every thickness. No other shear has this outstanding feature.

It was only after a thorough study of all makes of shears that Follansbee decided upon Steelweld. And it has fully proven up to expectations.

It makes the cuts as desired in metals of various characteristics. It is fast and easy to operate. All parts are readily accessible and the many adjustments provided minimize and simplify maintenance.

Steelweld Shears are the very latest and most modern on the market today with a host of points of superiority. We urge you to get all the facts on them.



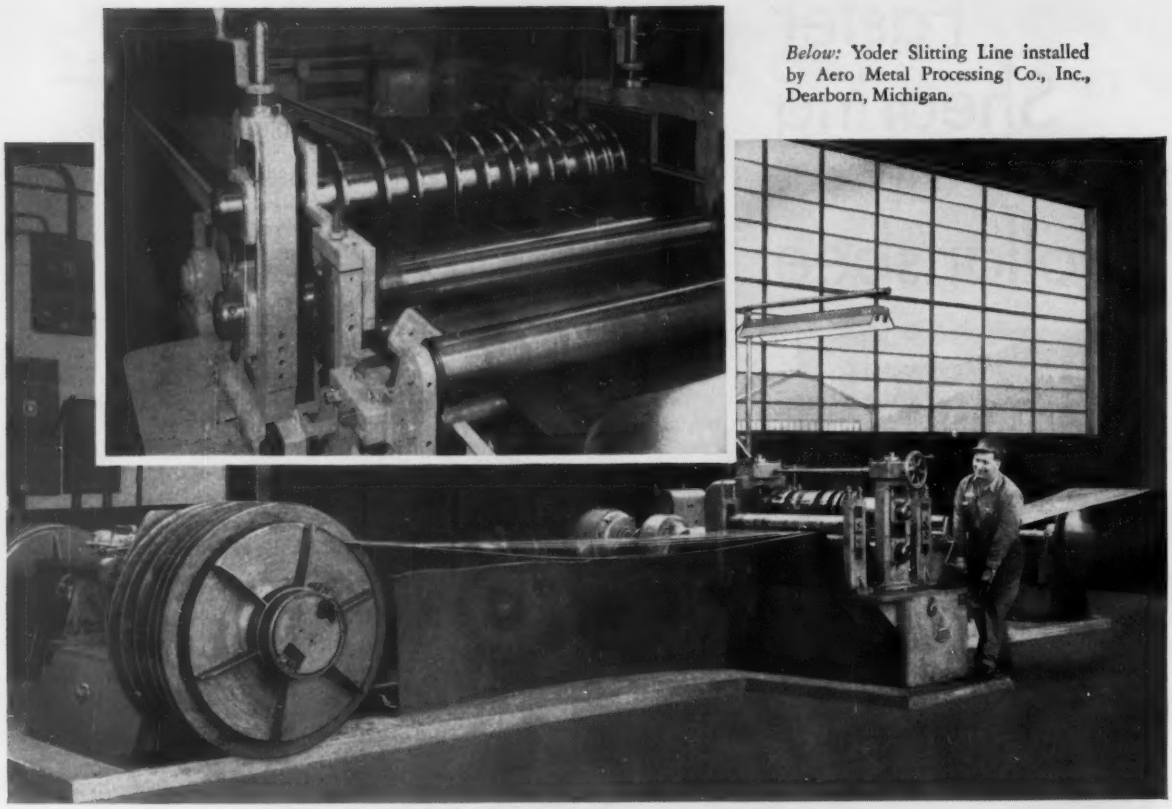
GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

5445 East 282 St., Wickliffe, Ohio

STEELWELD PIVOTED BLADE SHEARS



Below: Yoder Slitting Line installed by Aero Metal Processing Co., Inc., Dearborn, Michigan.

When is a Slitting Line Profitable?

● Many variables are to be considered in determining where and when a slitting line becomes a good investment. Also of what size, type, speed it should be, and other special features required to make it most profitable under any given set of conditions. Without obligation, a Yoder representative will call upon request and discuss such details with you.

The Yoder Slitter Book deals extensively with basic considerations in the choice and operation of slitting lines; points out, for instance, how and where a relatively small, inexpensive installation may be more economical than a larger, faster, and costlier one. (Yoder makes all types). Time studies show how coil size, strip gauge, slitter speed, coil handling and banding time affect cycle time and cost per ton.

The book is useful not only to present operators of slitting lines but to producers, users and distributors of strip and sheet metal who may be considering installing slitting equipment. A copy is yours for the asking.

THE YODER COMPANY
5504 Walworth Ave. • Cleveland 2, Ohio

Complete Production Lines

★ **COLD-ROLL-FORMING** and auxiliary machinery
★ **GANG SLITTING LINES** for Coils and Sheets
★ **PIPE and TUBE MILLS**—cold forming and welding

ENGINEERING YODER MANUFACTURING

For more information on products advertised, use Inquiry Card, page 255

Ten Million TOCCO*-Hardened Axle Shafts

Battery of TOCCO machines for hardening automotive axle shafts. TOCCO*-hardened shafts show an increase of up to 200% in resistance to torsional fatigue over furnace-hardened shafts made of alloy steel.

Give Super Service to American Motorists

...Save Manufacturers $2,000,000

The application of TOCCO* Induction Heating to the surface hardening of rear axle drive shafts for passenger cars and trucks provides a fine example of how a less expensive manufacturing method often results in the best possible end product.

For instance, TOCCO* Induction Hardening permits the substitution of easier machining carbon steels for expensive alloys, saving from 25¢ to 55¢ per car in material costs alone. Additional savings result from the fact that TOCCO eliminates the need for annealing, tempering and shot peening operations formerly required. Moreover, long hauls to and from the heat-treating department are eliminated because cool, clean TOCCO* fits right in the production line—next to related operations.

If you make parts that require hardening, annealing, brazing, or heating for forging or forming, it can pay you handsome dividends to investigate TOCCO* Induction Heating as a sound method of improving product quality *while reducing costs.*

THE OHIO CRANKSHAFT COMPANY

TOCCO

*Trade Mark Reg.

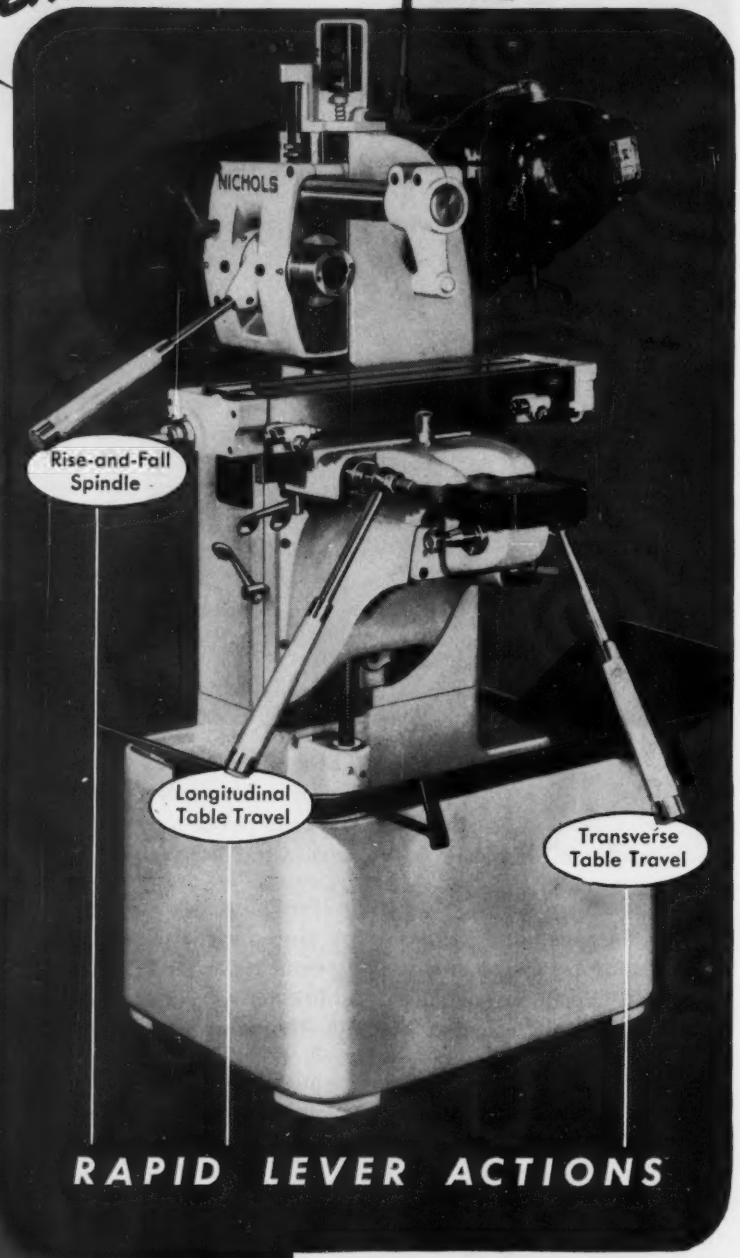
Mail Coupon Today

NEW FREE BULLETIN

THE OHIO CRANKSHAFT CO.
Dept. M-1, Cleveland 1, Ohio
Please send copy of "Typical Results of TOCCO Induction Hardening and Heat Treating."

Name_____
Position_____
Company_____
Address_____
City_____ Zone____ State_____

LATHE CARRIAGE FLEXIBILITY



Nichols Miller

PRODUCTION MODEL

Precision turning, boring and recessing jobs that are normally assigned to toolmaker's lathes or expensive boring machines, come natural to the versatile NICHOLS Millers.

Rapid Lever Actions on the Spindle Head, Table, and Saddle provide unparalleled flexibility of movements. The Lever Transverse Feed, an exclusive NICHOLS development, is especially valuable. Makes NICHOLS different from other hand millers. It adds *"lathe-carriage flexibility"* to your most intricate machining operations, while maintaining tolerances to "tenths." Work can be chucked lathe-fashion on the spindle with tools mounted on the table or vice versa.

Adjustable positive stops, quick-acting locks on sliding movements, and the highest degree of precision are standard equipment.

"THE MILLER THAT USES ITS HEAD"

Send for free illustrated brochure.

MANUFACTURED BY W. H. NICHOLS COMPANY, WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS

NICHOLS-MORRIS CORPORATION

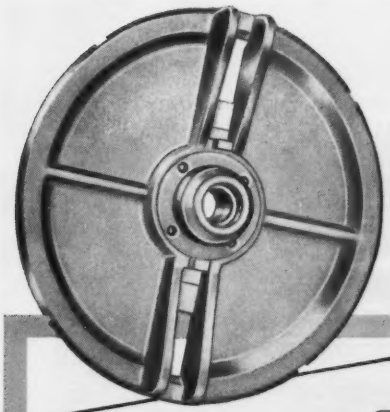
76-E Mamaroneck Ave., White Plains, N.Y.

CONDENSED SPECIFICATIONS

Table Working Surface	6¾" x 21"
Longitudinal Table Travel	10"
Transverse Table Travel	7"
Vertical Travel of Knee	13"
Rise and Fall of Spindle	4½"
Selective Speed Ranges up to	5000 R.P.M.
Weight	1250 lbs.

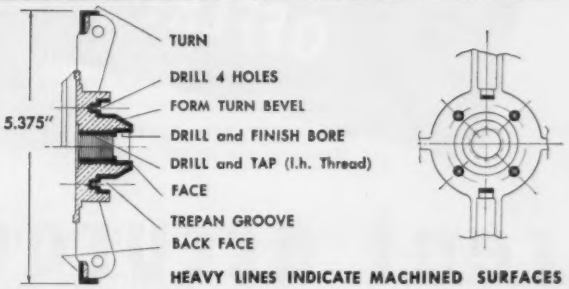
For more information on products advertised, use Inquiry Card, page 255

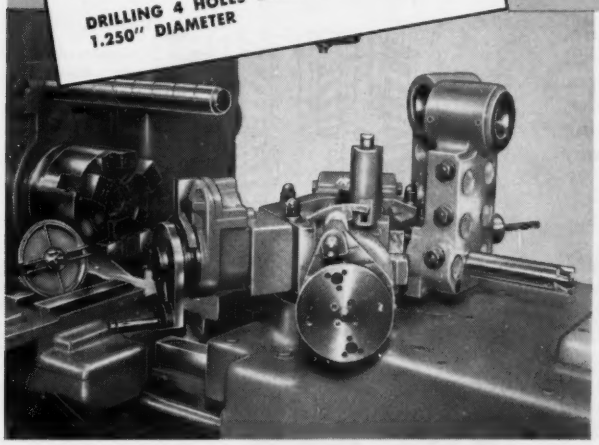
RIGHT WAY
to machine
LEFT HAND Threads!



JOB FACTS:

PART NAME — FLYWHEEL
MATERIAL — BRONZE CASTING
MACHINING — 10 SEPARATE CUTS — INCLUDING
TAPPING A 9/16-12 NC LEFT HAND THREAD
AND
DRILLING 4 HOLES SIMULTANEOUSLY ON A 1.250" DIAMETER



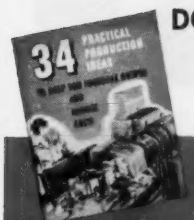


ALL COMPLETED IN A SINGLE OPERATION... IN 1.65 MINUTES ON A 3-U SPEED-FLEX Automatic WITH P&J TOOLING

It takes a really fast-cutting P&J Automatic — like the 3-U Speed-Flex — to turn out 31 of these precision parts every hour. And it takes truly efficient P&J Tooling to handle all of the specified cuts in a single, fully automatic cycle with no secondary operations required. The close-up of the tooling shows the special P&J-designed Head that drills all 4 holes at once in definite relation to the cast grooves in the piece . . . and the P&J Tapping Unit that machines the 9/16 — 12NC left hand thread.

DON'T overlook opportunities like this for reducing costs, increasing profits and improving product quality.

DO send today for your copy of "34 Practical Production Ideas" Booklet . . . and ask P&J Tooling Engineers to submit recommendations based on your own sample parts or prints.



MODERNIZE with POTTER & JOHNSTON REPLACE FOR PROFIT

WRITE DIRECT OR CONTACT YOUR NEAREST PRATT & WHITNEY BRANCH OFFICE

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EXPORT DEPT., PAWTUCKET, R. I.
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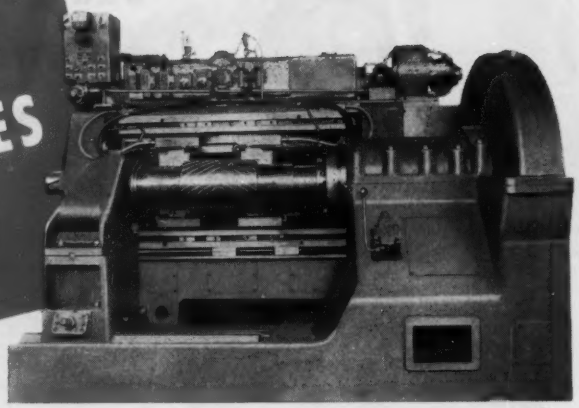
POTTER & JOHNSTON CO.
PAWTUCKET, RHODE ISLAND
SUBSIDIARY OF
PRATT & WHITNEY
DIVISION NILES – BEMENT – POND COMPANY

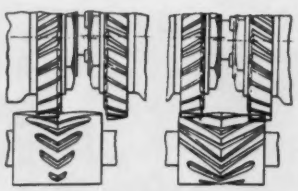
PRECISION PRODUCTION TOOLING — FOR MORE THAN FIFTY YEARS

FARREL-SYKES GEAR MACHINES OFFER:



great accuracy { precision generation }

Farrel-Sykes "Twin-Head" gear generators provide utmost precision in the generation of all types of gears that operate on parallel axes. Built with initial precision of the highest order, they are provided with means of compensating for wear and maintaining precision for many thousands of hours of operation.



over widest work range

Farrel-Sykes gear generators are made with the work axis horizontal, the same position in which the gears themselves run. This permits a wide variety of work to be handled on a single machine and controls the work more positively. At the right are *some* of the many different gears and parts that you can make on a Farrel-Sykes "Twin-Head" generator.

at faster cutting speeds!

The new Farrel-Sykes gear generators cut gears as much as 33⅓% faster than preceding models. This means fewer man and machine hours, and a substantial decrease in manufacturing costs.

Setup time has also been reduced, and operation made easier. Rapid selection of speeds and feeds, simple adjustment of cutters, and positive control of infeed, are a few examples.

Ask for bulletin T-455.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y. • *Sales Offices:* Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston.

FB-969

Farrel-Birmingham®

For more information on products advertised, use Inquiry Card, page 255

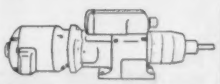
Swanson TURRET INDEXING UNITS

Lower the cost of Automation

These versatile, "packaged" units provide the basic chassis for a wide range of special automatic machines for precision machining, processing or assembling operations on small and medium parts. Because they eliminate much of the engineering and building time formerly required, Swanson units lower costs and shorten completion time . . . considerably broadening the practical applications for automation. Further, because of the simplicity with which standard or special operational devices can be grouped around the turret, a wide latitude of tooling arrangements is possible. Interchangeable turret assemblies and mounting brackets are available for complete tooling changeover.

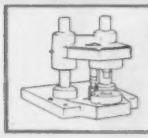
ONLY SWANSON PROVIDES A STANDARD TURRET INDEXING CHASIS WITH THESE FEATURES:

Stationary center plate for mounting or supporting operational devices.

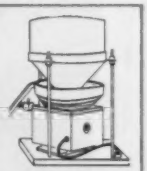


Turret diameters of 20, 30 or 40 inches for mounting 6, 8, 16, 24 or 32 work stations.

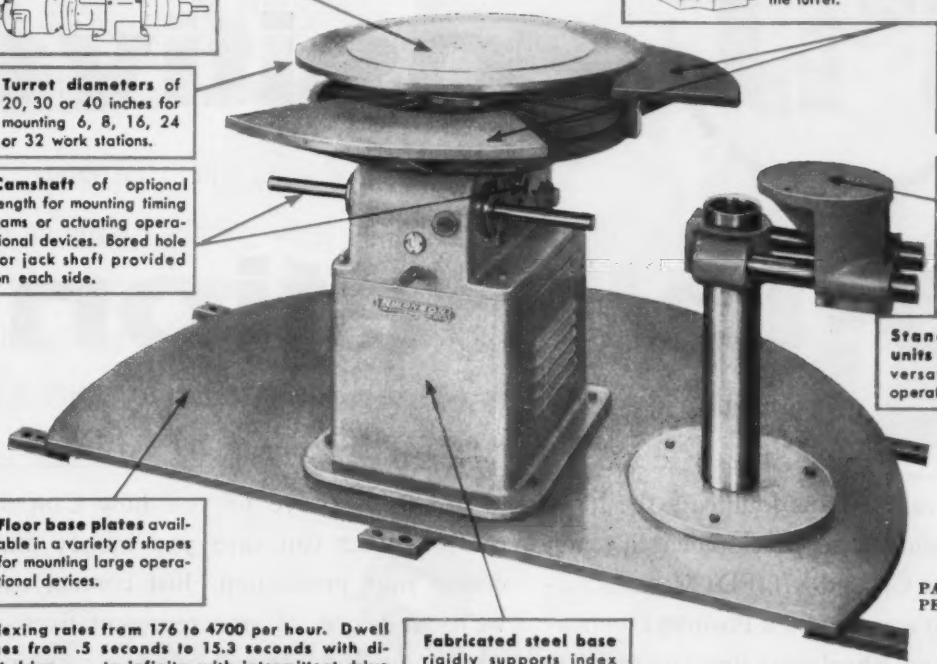
Camshaft of optional length for mounting timing cams or actuating operational devices. Bored hole for jack shaft provided on each side.



Mounting brackets of optional widths may be located on radial keyway in any positions around the turret.



Standard pedestal units provide additional versatility in mounting operational devices.



Floor base plates available in a variety of shapes for mounting large operational devices.

PATENTS PENDING

Indexing rates from 176 to 4700 per hour. Dwell times from .5 seconds to 15.3 seconds with direct drive . . . to infinity with intermittent drive models. Exclusive cross-over cam and locking device assure harmonious indexing and accurate positioning at all work stations.

Fabricated steel base rigidly supports index housing and encloses motor, drive and wiring.

Write for Bulletin TM

Quality SWANSON TOOL & MACHINE PRODUCTS INC., ERIE, PA. *Since 1919*

ENGINEERS AND BUILDERS OF SPECIAL AUTOMATIC MACHINERY

A development that is making grinding wheel history

NOW!

Cincinnati Grinding Wheels offer

Positive Duplication

Positive Duplication is undoubtedly the most important grinding wheel development in years. For through the CINCINNATI (PD) Manufacturing Process you are assured a Positive Duplication of the original wheel *every* time you reorder.

"On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will *act and grind exactly alike. Yet they are priced no higher than ordinary wheels.*

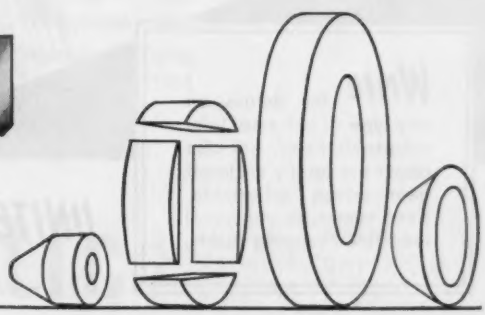
Let us prove to you how CINCINNATI (PD) WHEELS can save you money and increase your production. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

Just as a NEGATIVE guarantees you an exact duplication of a photograph each and every time, you are always assured a . . .

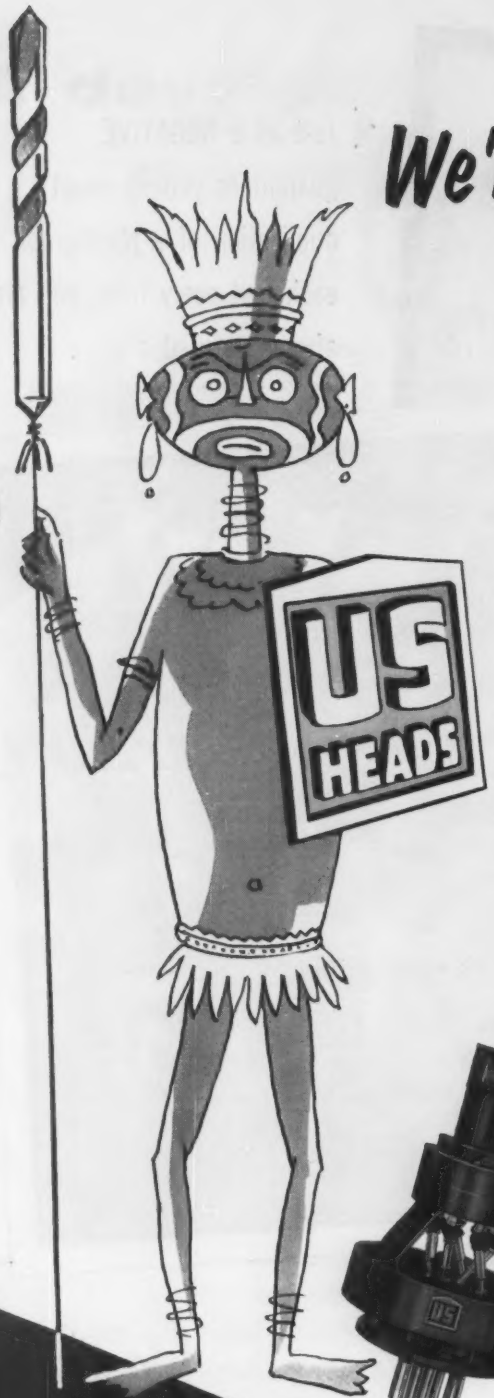
. . . POSITIVE DUPLICATION of an original grinding wheel each and every time through the CINCINNATI (PD) Manufacturing Process.

CINCINNATI
Grinding Wheels

THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio



We're Looking for Head Hunters!....



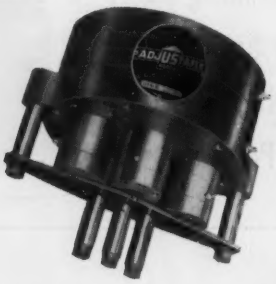
Most machine tool men have long relied upon the "US" Adjustable Multiple Spindle Drill Heads. But we are looking for those who still haven't tried them . . . and who are looking for the best.

With their quick-change universal joint assemblies, they are built for continuous use, with full anti-friction bearing construction for high capacity thrust loads. The universal joint adjustable multiple spindle type is suitable for any sensitive drilling machine. Joints are self-lubricating. All gears are hardened and shaved with spindles superfinished.

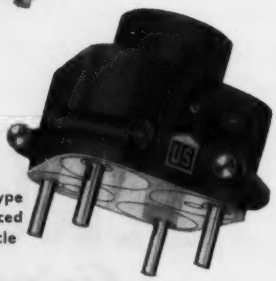
The single eccentric type is used for equally spaced holes on bolt circles.

The new double eccentric AdjUStafix, two to eight spindles, permits spindles to be located in non-symmetrical patterns. It eliminates expensive change in set-up.

Universal joint with slip spindle fixed locating plate



Double eccentric type for irregular spacing



Single eccentric type for equally spaced holes on bolt circle

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear-driven adjustable, fixed center, or individual lead screw tapping heads.

UNITED STATES DRILL HEAD COMPANY

616-618 BURNS STREET • CINCINNATI 4, OHIO

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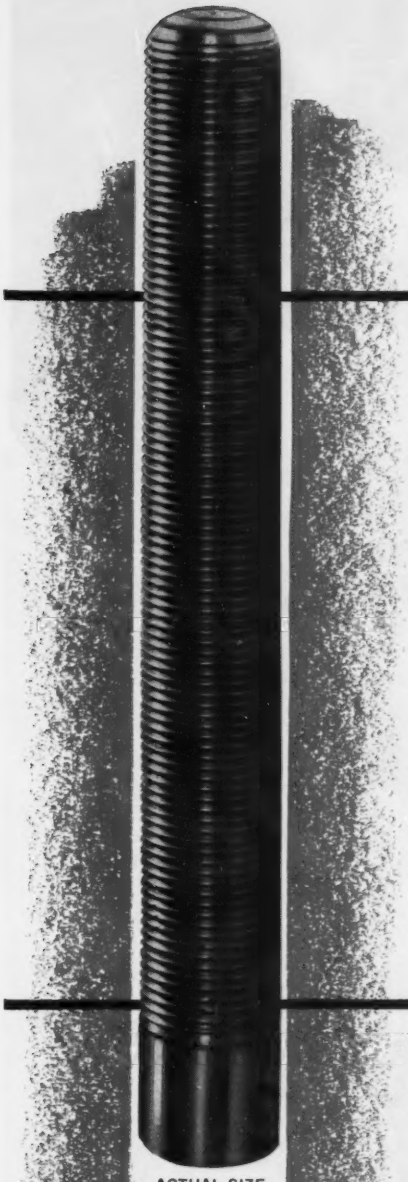


ACTUAL SIZE

when the odds don't have it...

Before putting the chips down it is well to realize that reliable machine performance is largely dependent on well balanced tooling. If it is a multiple spindle bar automatic, an even number of work spindles provides a better opportunity for balance than an odd number.

Odd or even, the work spindles are only one of many important considerations in the selection of an "automatic". Other factors also important to the individual machine user are suggested by the new Conomatic General Datalog. Copies are now available.

data for comparison

Part	**Levelling Screw**
Machine	**1⅝" Six Conomatic**
Tools	**100% Carbide Tipped**
Material	**B-1112**
Stock Size	**1" Round**
R. P. M.	**Work Spindle — 958** **Opposed Spindle — 677**
Time	**7.25 Seconds per Cycle** **3.6 Seconds per Piece**

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

WORLD'S HANDIEST HOIST

- Pull it down
- Hook on load
- Run load up

KELLER AIR HOIST
SIZE 86A-1

150-LB.
CAPACITY

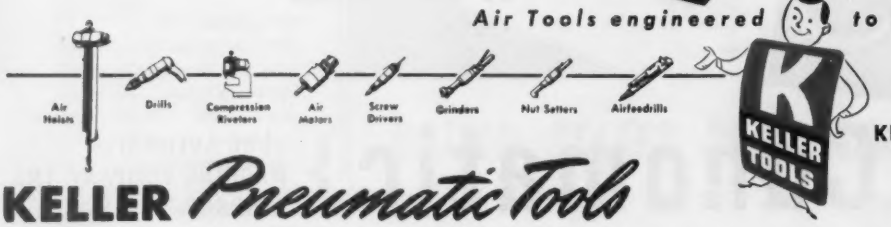
Here is an entirely new lifting tool that saves time and manpower on those troublesome handling operations in the 50- to 150-pound range . . . gives added strength to production workers for repetitive lifting jobs . . . frees larger hoisting equipment for heavier loads.

This new Keller Hoist weighs only 14 pounds —easy to suspend from any overhead support. For the complete story on the new 86A-1 Hoist, and how it can simplify your material handling, write for Catalog Section 86A.

features:

- One-hand control—operator can reach out, pick up, and place 150-pound load with one hand.
- "Free-wheeling" pull-down —permits reaching for loads quickly, with almost no resistance.
- Wide speed range—loads raised or lowered at any speed up to 40 fpm.
- Continuous service—air motor cannot overheat or burn out from overload or all-day operation.

Air Tools engineered to Industry



KELLER *Pneumatic Tools*

KELLER TOOL COMPANY
1307 Fulton Street
Grand Haven, Michigan

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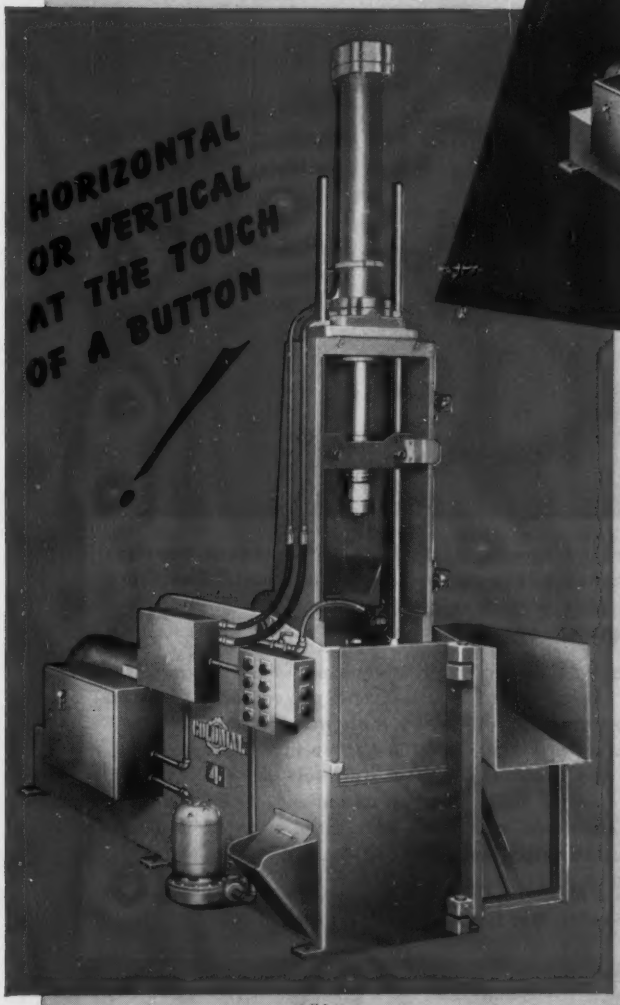
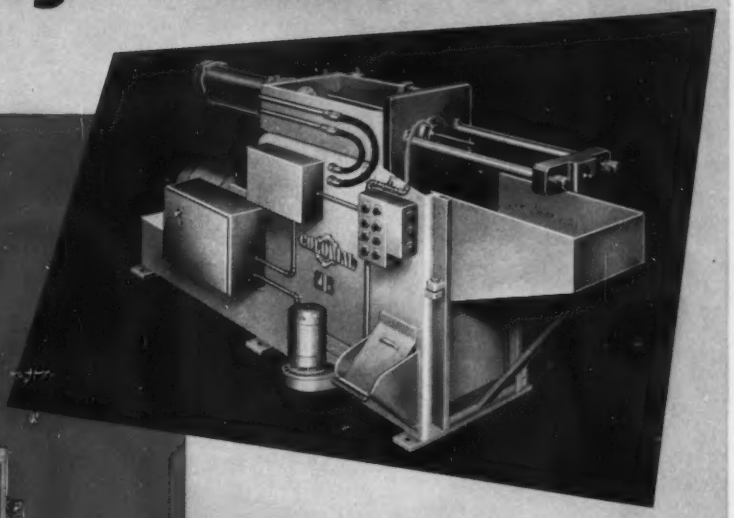
Announcing....

the COLONIAL "4" *Convertible* Broaching Machine





This amazing new Colonial "4" broaching machine is the answer for the shop that requires a broaching machine flexible enough to be changed from horizontal to vertical and back in a matter of seconds.

It is truly multi-purpose— performing any of four operations:

1. **Push broaching**
2. **Pull-down broaching** } **vertical position**
3. **Press work**
4. **Pull broaching.....horizontal position**

Rated capacity is six tons for pull-down broaching, push broaching, or press work, and four tons for horizontal pull broaching. Stroke capacity is 28" in horizontal and 24" in vertical position. Guide-bar construction maintains accurate alignment throughout the working stroke for pull-down broaching. Safety interlocks prevent tilting the machine unless the ram is retracted.

Ask for bulletin FW-55 for complete description of the Colonial "4" Convertible.

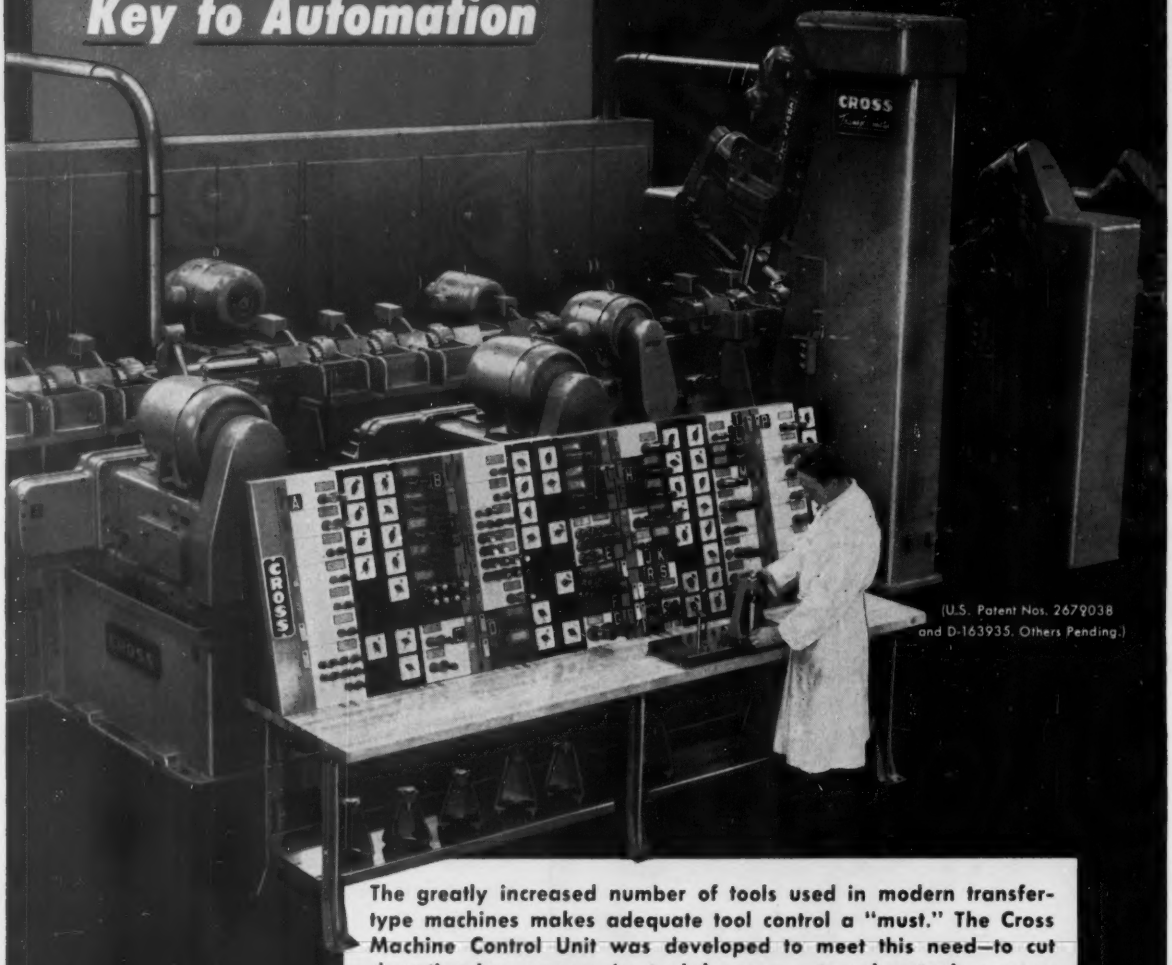
PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO. DETROIT 13

Cross Machine Control Unit— Key to Automation

A Mechanical Eye to Watch Your Tools



(U.S. Patent Nos. 2679038 and D-163935. Others Pending.)

The greatly increased number of tools used in modern transfer-type machines makes adequate tool control a "must." The Cross Machine Control Unit was developed to meet this need—to cut downtime by programming tool changes . . . to reduce tool expense.

The Cross Machine Control Unit is equipped with Toolometers which furnish a visual record of used and unused tool life and *automatically stop the machine when tools need changing*. Other tools almost used up are replaced at the same time. This grouping of changes, plus the availability of pre-set tools which are stored in the Machine Control Unit, reduces downtime. And downtime for machine adjustments and trial cuts is eliminated because standard fixtures and gages are provided for pre-setting the tools.

Over 500 Cross Machine Control Units now in use are evidence of cost saving benefits. Get full information today.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

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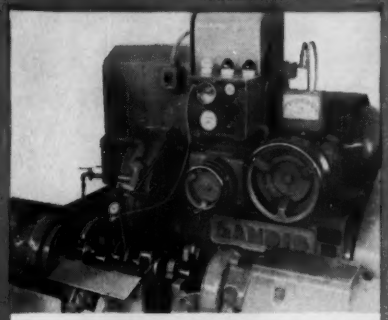
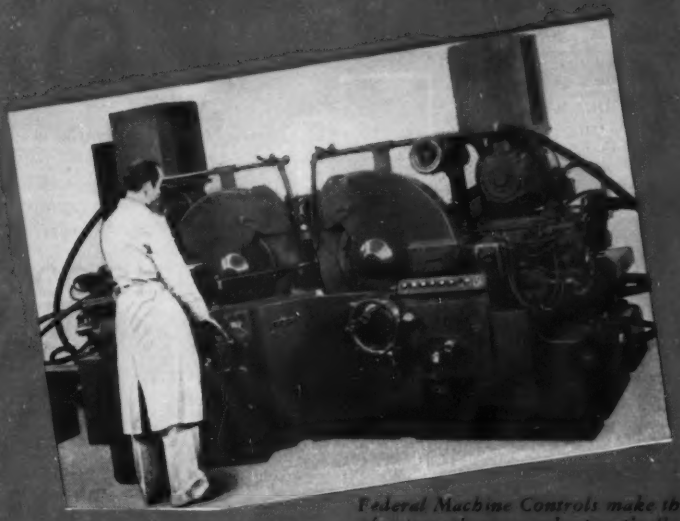
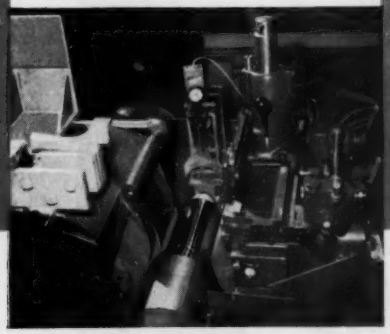


Grinding Main Journals on a Crankshaft is done quickly and without scrap with this Federal Air-Electric Grinding Gage. The operator loads the machine, snaps the caliper on the work and starts the machine cycle. When the work is down to size, the wheel automatically backs up. The large Air Dial and the three signal lights provide visual checks on the progress of the grinding. With this Machine Control Gage it is impossible to grind undersize scrap because the gage automatically backs the wheel up when work is to size.



Federal Machine Controls make the grinding of automotive rear axles practically automatic.

FEDERAL *Automatic* MACHINE CONTROL GAGES



This Federal unit, employing an Arnold continuous caliper type grinding gage, automatically controls the size of the journal surfaces of 1100 lb. freight car axles. The gage, ordinarily retracted to provide loading clearance, automatically springs onto the work and takes control of the grinding process at the start of the grinding cycle. Signal lights tell the operator when work is "over size", "near size", or "to size" and are connected electronically to the machine controls so the grinding cycle is automatically stopped when the required size is obtained. Tolerances are consistently maintained well within the plus 0.0005", minus 0.0000" specified.

Grinding Spacer Plates on this parallel disc grinder is an automatic operation with Federal Machine Control. Workpieces are loaded in the slotted carrier wheel and the gage controls the feed of the wheels to compensate for wheel wear. Corrections are made alternately to each wheel-head to maintain the centering of the carrier wheel. Automatic controls assure continuous production of good pieces, eliminating scrap.

A few of many applications

have established their efficiency

AUTOMATION is a new term applied to an idea that general machinery manufacturers have been doing ever since Eli Whitney invented his Cotton Gin. But, controlling Machine Tools automatically so that they produce work to required sizes is comparatively new.

Federal, however, has been designing and building Gages for this purpose for several years. We offer this tried and proven experience to all builders and users of machinery where Automatic Dimensional Control of Machine Tools is desired. We can handle all phases of the work; from work-handling through gaging, machine control and disposal.

Federal is ready to provide standardized package units for air, electrical, electronic or combination controls and **will cooperate with your engineers to adapt these to your machine requirements.** Call —

FEDERAL PRODUCTS CORPORATION
5111 EDDY STREET • PROVIDENCE 1, RHODE ISLAND

SOME OF MANY POSSIBILITIES

Percentage reject control. A simulation of automatic statistical Q.C.

Automatic shut-off when dimension out-of-control.

Automatic tool adjustment or compensation.

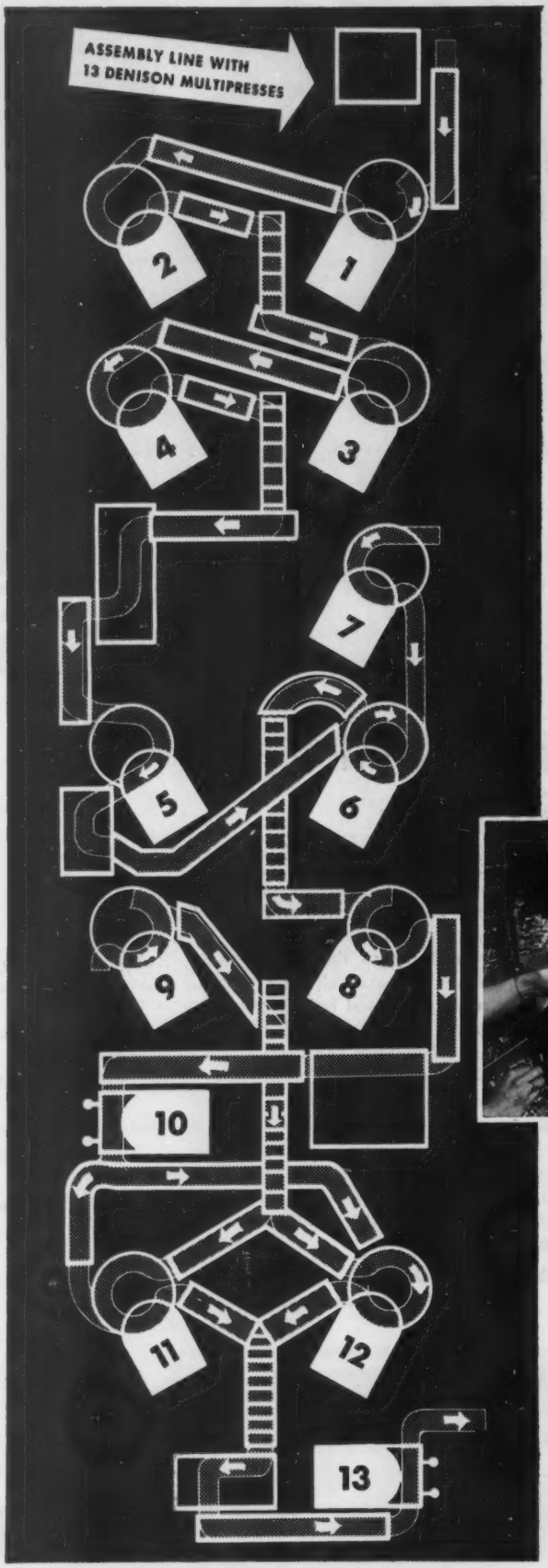
Tool Adjustment Signalling.

Automatic classification according to dimension.

Automatic line operation signals, etc., etc.

Ask **FEDERAL**
FOR ANYTHING IN MODERN GAGES . . .

for Inspecting, Measuring, Sorting or Automatically Controlling Dimensions on Machines



Assembles 13,000 auto door-locks per day with DENISON MULTIPRESS®

THIS COMPANY set out to assemble 10,000 auto door-locks per 16-hour day . . . beat its goal by 3000 with Denison Multipress.

With a line of 13 Denison hydraulic Multipresses, Reid Products Division of The Standard Products Company assembles 13,000 door-locks . . . 34 pieces per lock.

Parts are carried on conveyors and chutes. Operators load component parts on Denison Index Tables which position them under the hydraulic ram up to 70 times a minute.

Loading for staking of five-part sub-assembly

Assembly line takes up only 500 square feet.

If you have a problem in automatic operation. . . or any job that calls for controlled pressures up to 75 tons, bring it to Denison. Write to:

THE
DENISON ENGINEERING COMPANY
1244 Dublin Road • Columbus 16, Ohio

DENISON Hydr OIL ics

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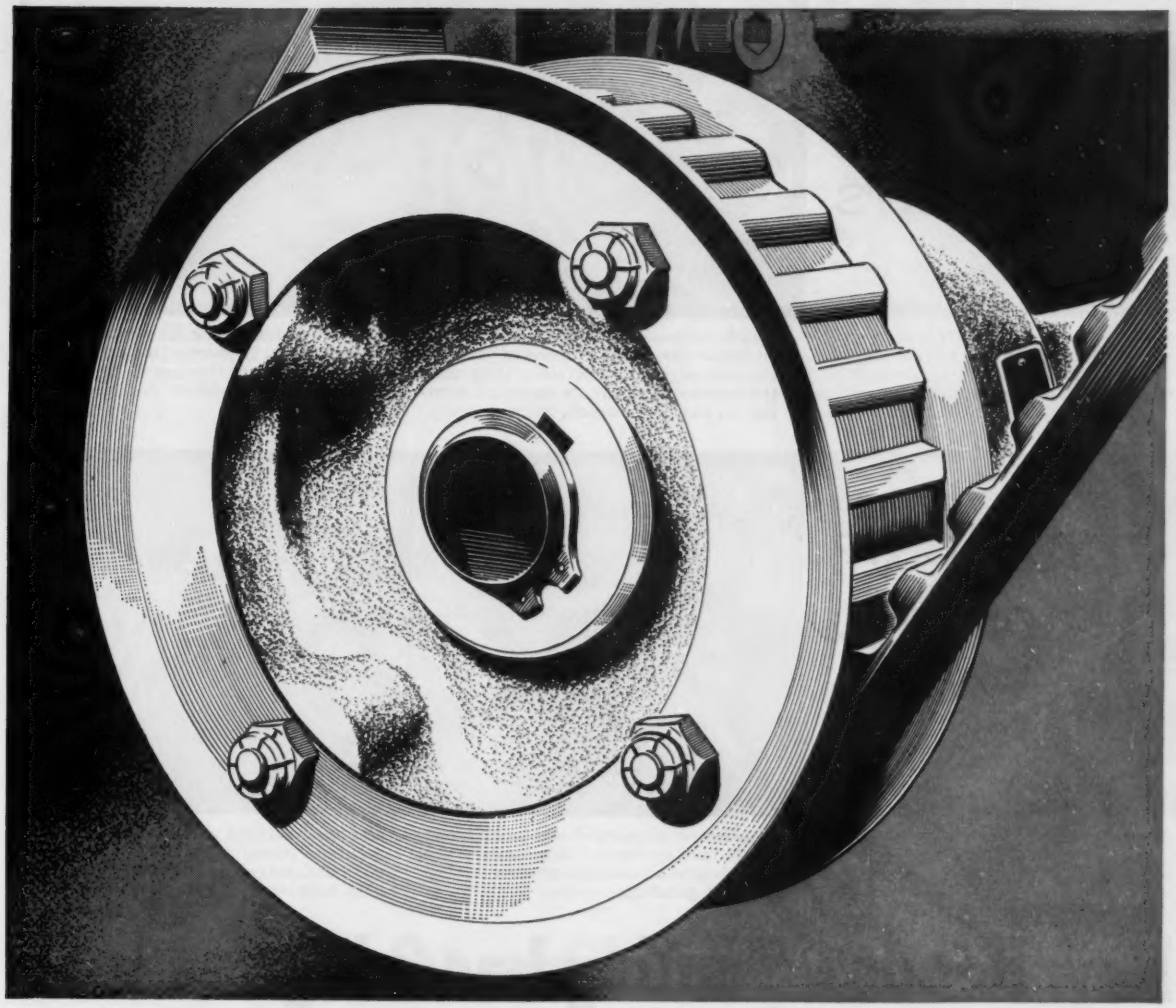
FLEXLOC AT WORK



MORE AND MORE FLEXLOC LOCKNUTS are being used to hold assemblies like this one together. This modern timing belt drive combines the flexibility of a steel cable belt with the positive action of a silent chain drive permitting its use at speeds up to 15,000 rpm.

FLEXLOC Self-Locking Nuts offer the same positive action as the drive. Once the locking threads are fully engaged, the nuts won't work loose, regardless of the vibration encountered. And FLEXLOCS are reusable.

FLEXLOCS are available in a wide range of sizes in any quantity. Stocks are carried by leading industrial distributors everywhere. Write for Bulletin 866 and samples for test purposes. STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

DO YOU KNOW? Standard FLEXLOCS clean rough threads on bolts, and make them even better. The locking threads on all-metal FLEXLOCS are not chewed up when used on rough bolts.

Standard FLEXLOCS lock securely on bolts varying in diameter tolerances. The all-metal, resilient locking sections of the nut accommodate themselves to the diameter tolerances.

Standard FLEXLOCS are one piece, all metal. They are not affected by temperatures to 550°F. Nuts lacking these features have a more restricted temperature range.

Standard FLEXLOCS lock securely—stopped or seated—when 1½ threads of a standard bolt are past the top of the nut.

Standard FLEXLOCS are not affected by moisture, oil, dirt or grit. They lock efficiently under all conditions, regardless of the vibration encountered.

FLEXLOC®

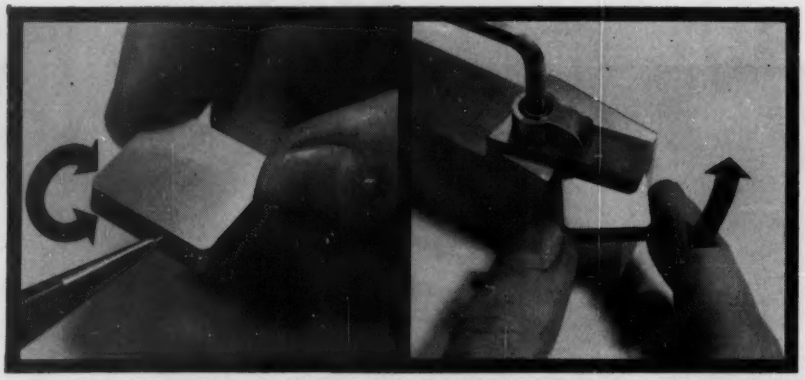
LOCKNUT DIVISION

sps

JENKINTOWN ■ PENNSYLVANIA

For more information on products advertised, use Inquiry Card, page 255

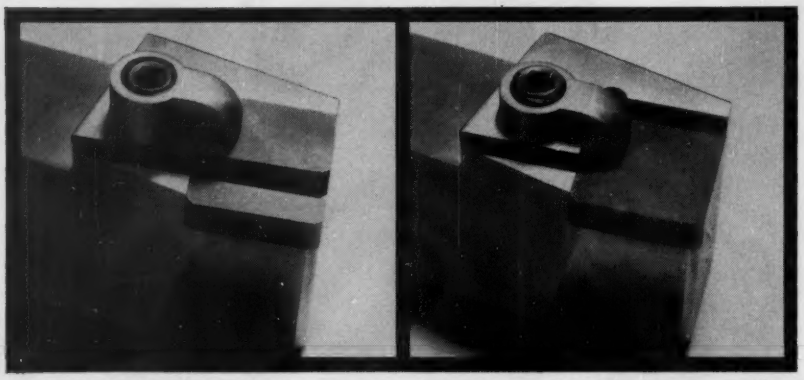
NEW "TURNOVER" INSERTS



You have twice as many cutting edges on these clamp-on, "turnover" inserts. Use all edges on one side, then turn the insert over and use an equal number on the reverse side.

You can index a new Kendex insert in seconds. Simply loosen the sturdy top clamp and turn the insert to a new cutting edge . . . without disturbing the tool setup.

NEW CHIP CONTROL SYSTEM



These new Kendex Tools have an entirely new system of chip control that completely eliminates expensive chip-breaker grinding.

Clamped carbide chip breakers can be removed when not needed. Clamp has sufficient travel to hold insert without chip breaker.

New Kendex* Tooling has 2 big features

COST COMPARISON

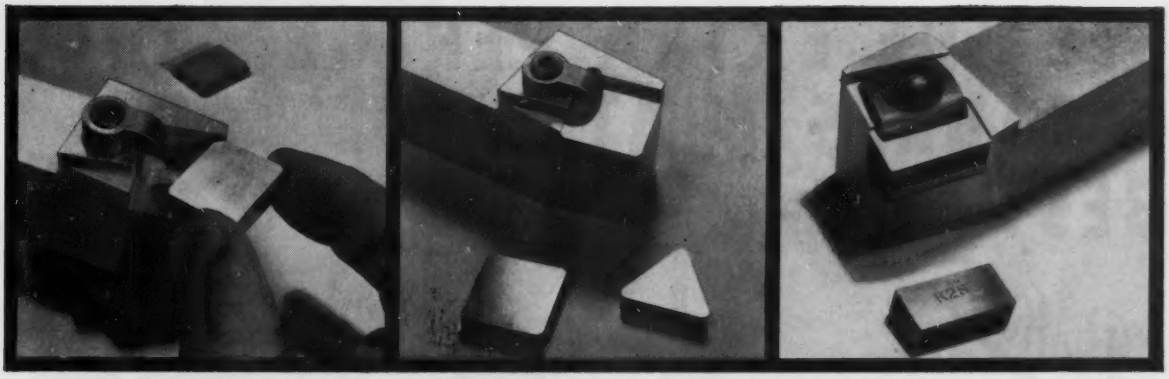
(¼-inch tools required to provide 160 cutting edges)

Standard Brazed Tools		Kendex KBR-12	
Cost of 23 tools	$ 44.62	20 inserts	$20.40
Regrind expense**	61.90	1 holder	6.50
Total cost	$106.52	Total cost	$26.90
Cost per edge	66.5¢	Cost per edge	16.8¢
**Six grinds per tool			

Total Kendex Savings $79.62

*Registered Trademark

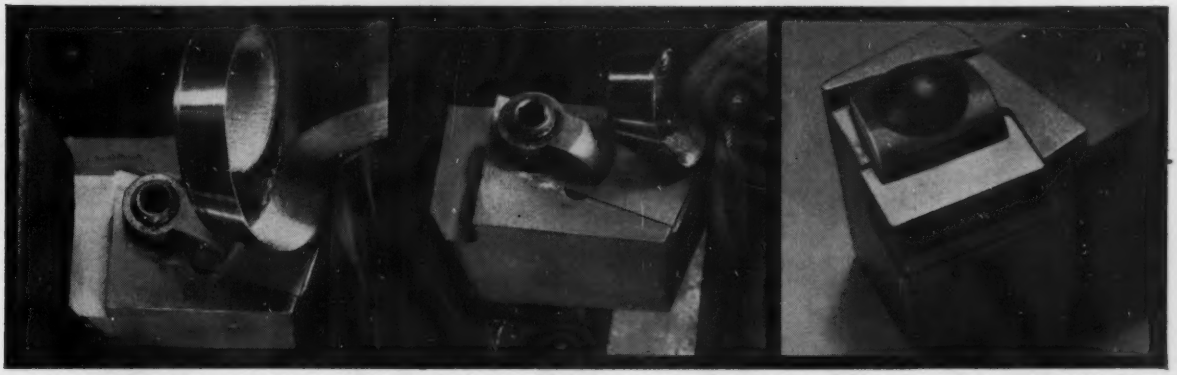
MINING, METAL AND WOODWORKING TOOLS WEAR AND HEAT-RESISTANT PARTS ABRASION, CORROSION-RESISTANT



Each replacement insert fits accurately into the rugged, heat-treated shank, with the cutting edge perfectly aligned for use. No complex mechanism to adjust or fail.

For Standard Tools: "Regular" inserts (corner radii, top, and bottom surfaces ground) and "Precision" inserts (all surfaces ground) are available in square and triangular shapes.

For Heavy-Duty Tools: Standard molded blanks ground only on the corner radii for lowest possible cost per cutting edge. These blanks index within plus or minus 0.005 inch.



The carbide chip breakers on these tools have the widest effective range of application of any mechanical chip breakers known.

An indication of their effectiveness can be obtained from the two illustrations above. At left, 0.014 inch feed; at right, 0.036 inch feed—using same tool.

Kendex Heavy-Duty Tools have rigid, spring clamps which serve as chip deflectors. These inexpensive clamps are easily replaced.

to help you cut machining costs

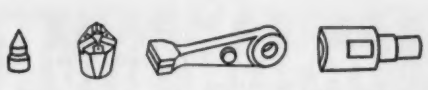
A series of clamp-on, "turnover" inserts and a new system of chip control are helping users of this new Kendex Tooling slash tool cost per cutting edge by completely eliminating expensive grinding operations.

Two tools, the Standard and the Heavy-Duty, are designed to use the new Kendex "turnover" inserts which have cutting edges on not one, but *both* sides. Use twice the number of cutting edges before replacing these cost-cutting, "throw-away" inserts. And, the new top-clamp tool design enables you to index them in less time than ever before.

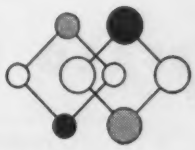
New Kendex Tooling not only eliminates regrinding of inserts, but the grinding of chip breakers as well. Standard sizes are equipped with replaceable, carbide chip breakers which can be removed, if desired. Heavy-Duty sizes are fitted with rigid, inexpensive spring clamps which serve as chip deflectors.

This combination of new "turnover" inserts and new system of chip control, plus the new top clamp for rapid indexing, is cutting tool costs on all types of machining operations wherever it is used.

See the cost comparison chart (*left*) and judge for yourself. This comparison indicates the *average* cost reduction that users have realized from this new Kendex Tooling. Call your Kennametal representative for a demonstration or write for additional information. KENNAMETAL INC., Latrobe, Pa. A 28



PARTS PERCUSSION AND IMPACT PARTS

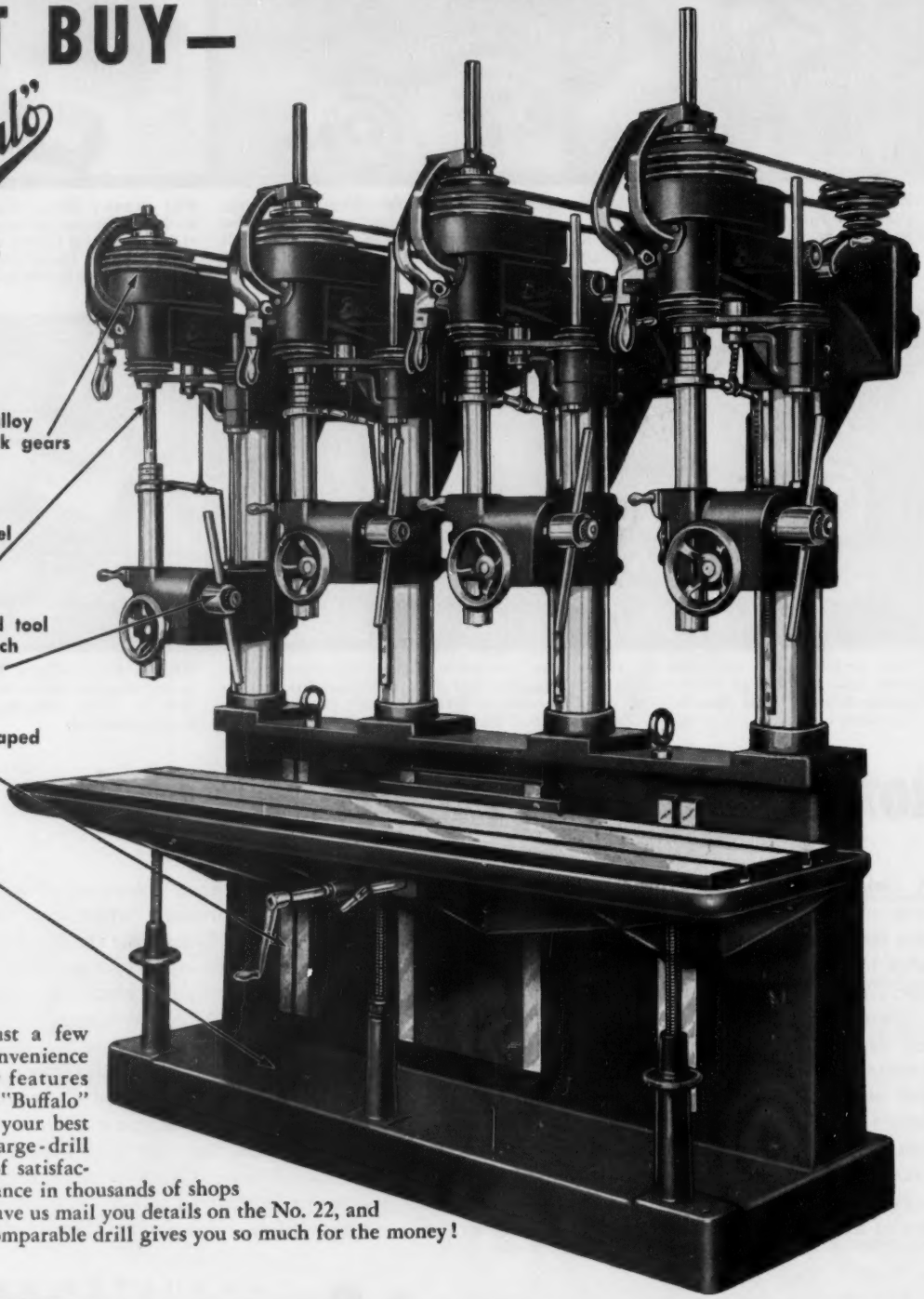


INDUSTRY AND
KENNAMETAL
...Partners in Progress

SEE THE EXTRA PERFORMANCE FEATURES THAT MAKE YOUR BEST BUY—

"Buffalo"

No. 22
DRILL


Forged alloy steel back gears
6 spline alloy steel spindle
Hardened tool steel clutch members
Hand-scraped ways
Coolant reservoir in base

Above are just a few long life, convenience and accuracy features that make the "Buffalo" No. 22 Drill your best buy in the large-drill class. Years of satisfactory performance in thousands of shops prove this. Have us mail you details on the No. 22, and see why no comparable drill gives you so much for the money!

"Buffalo"

BUFFALO FORGE COMPANY

440 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING • PUNCHING • SHEARING • BENDING

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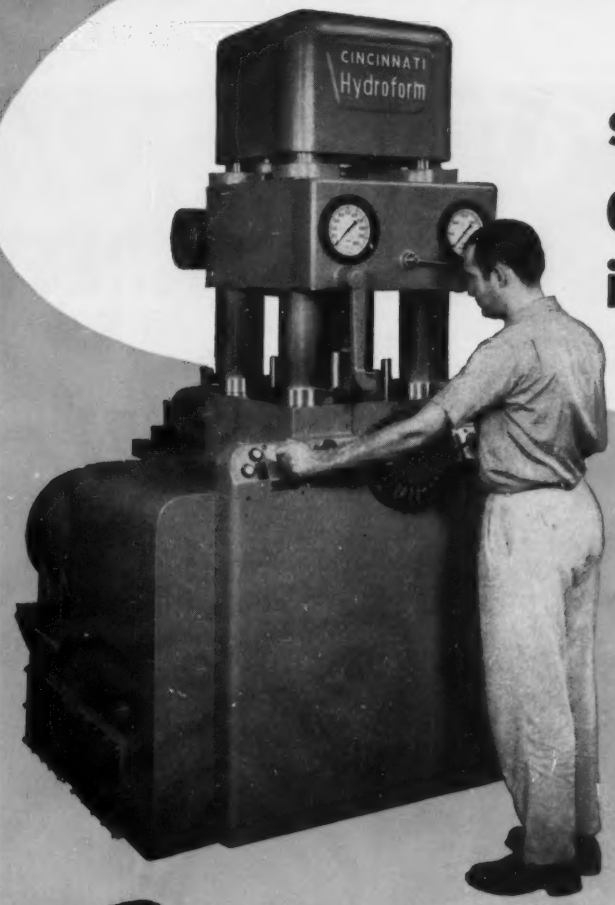


small size producer of BIG SIZE SAVINGS in metal forming . . .

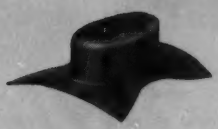
The New Cincinnati 8" Hydroform

The new Cincinnati 8" Hydroform duplicates the performance of its larger family members—the 12", 19", 23", 26", and 32" size machines—by producing a wide variety of deep drawn parts . . . with lower tooling costs . . . at a faster rate . . . and with higher standards of quality than is possible to obtain by other methods.

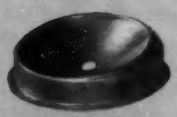
And it takes up less plant floor space than some soft drink dispensing machines occupy.

Typical examples of work formed on the 8" Hydroform are shown at left. Listed below is a table of major machine specifications.

If your manufacturing requires the production of drawn shapes in small lots—or extensive development work prior to quantity production—let a Cincinnati Milling field engineer show you how the many Hydroforming advantages can be profitably applied to your work. For a description of the Hydroforming process and specifications of the six machine sizes, write for Bulletin M-1759-3.



Cross-over Duct of .035" Type 321 stainless steel, drawn with contoured flange in one operation.



Reflector of .020" Aluminum, drawn, pierced and trimmed in one operation.

Electrical Detail of .042" stainless steel, drawn in two operations.

Jet Engine Detail of .032" Inconel, drawn with flange on an angle with the balance of the part in one operation.

Cover of .060" 2S0 Aluminum, drawn in one operation.

Work Capacity:
Maximum Blank Diameter—8"
Maximum Draw Depth—5"
Maximum Blank Gage—¼" Steel
Maximum Forming Pressure—15,000 psi

Machine Operating Rate:
Maximum—200 cycles per hour

Dimensions:
5' x 5' x 7½' high

Weight:
Machine Net—12,000 lbs.

Installation:
Floor Mounted. Requires water and electrical connections.

Hydroform

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

CINCINNATI

VK HIGH SPEED STEEL

THREAD MEASURING WIRES

...basic tools in a universally accepted method of checking screw threads

VK Set No. 20 HS Thread Measuring Wires, accurate to ±.000025″ for 20 common pitch Unified and American screw threads, 6 to 36 threads per inch.

The three-wire method is probably the best known and most widely accepted system of measuring pitch diameter of screw threads. Equipment required includes only a set of VK Thread Measuring Wires of proper diameter and an accurate measuring instrument.

Van Keuren Thread Measuring Wires have been developed over a period of many years of pioneering in the precise measurement field. They are made to National Bureau of Standards specifications, are held within .00002″ for roundness, straightness and identity and to within .000025″ of exact size.

VK Thread Measuring Wires are made of long-wearing, tough and beautifully finished high speed steel and are either 1-7/8″ or 2″ in length. Every wire is subjected to the closest criteria in today's standards of accuracy.

In addition to set No. 20, shown here, VK furnishes many other standard sets as well as special wires in diameters from .001″ to 1.500″.

The Van Keuren Catalog and Handbook No. 35 contains 91 pages of technical and engineering information on wire measurement of screw threads. This information, compiled from many years' research in the field, is available without charge by addressing: The Van Keuren Co., 178 Waltham Street, Watertown, Mass.

VK

36th YEAR

THE Van Keuren CO.,

178 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires Chrome Carbide Taper Insert Plug Gages

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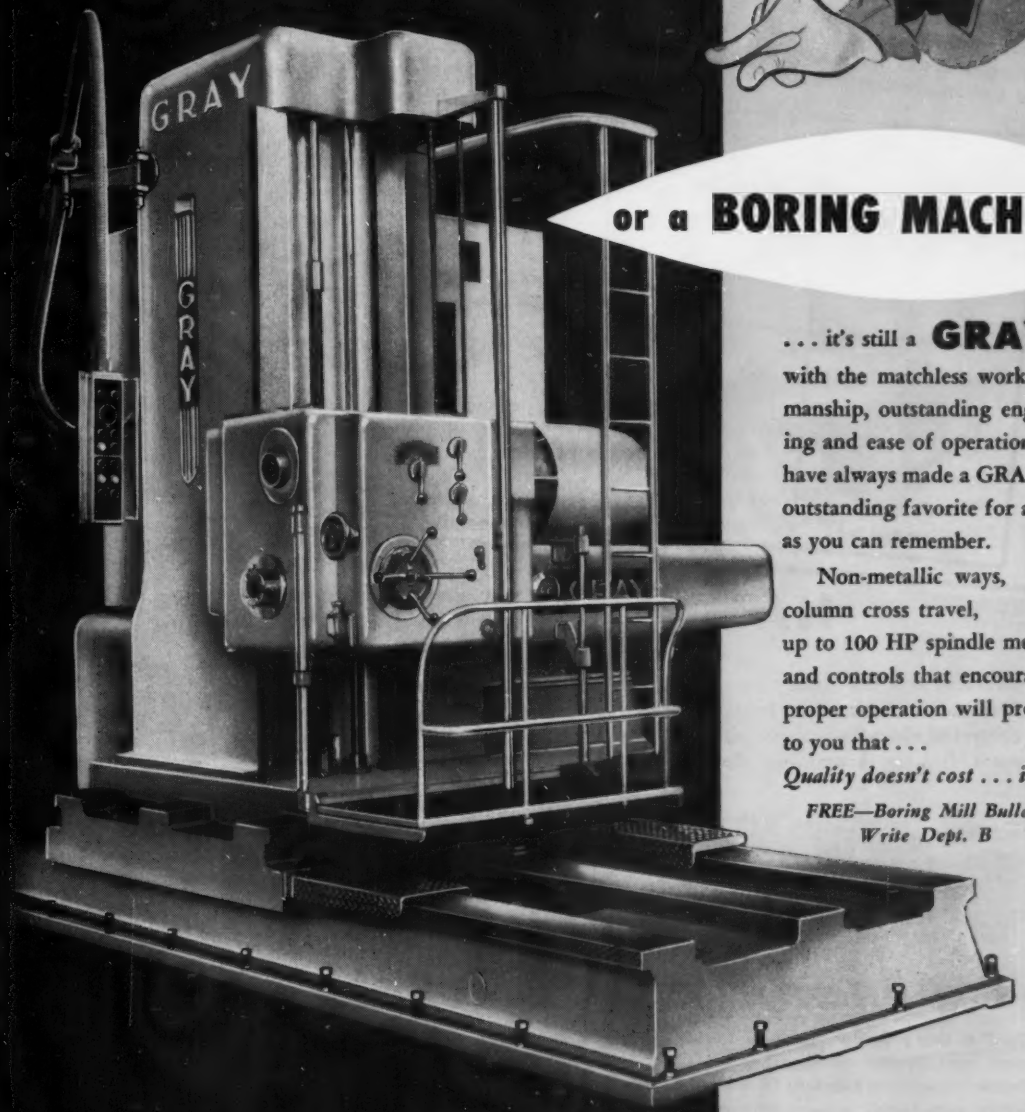
whether it's a . . . PLANER



or a BORING MACHINE

. . . it's still a **GRAY** with the matchless workmanship, outstanding engineering and ease of operation that have always made a GRAY the outstanding favorite for as long as you can remember.

Non-metallic ways, column cross travel, up to 100 HP spindle motor, and controls that encourage proper operation will prove to you that . . .

Quality doesn't cost . . . it pays.

FREE—Boring Mill Bulletin. Write Dept. B

The G.A. GRAY Company

planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.

SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

HANNIFIN SQUARE

SERIES "A" AIR CYLINDERS

Made in 11 bore sizes from 1½" to 14" . . . 13 standard mountings . . . many combinations. Extremely close tolerances insure accurate, easy mounting. Steel heads. Cylinders of hard-drawn, high strength brass honed to a satin finish. Piston rods ground and polished then hard chrome plated for extreme smoothness as well as corrosion resistance.

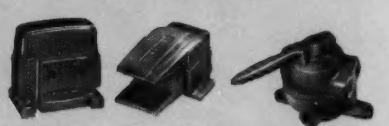
TYPICAL MOUNTING STYLES

WRITE FOR BULLETIN 213

Just off the press. The easiest catalog to use in the cylinder business. Write today.

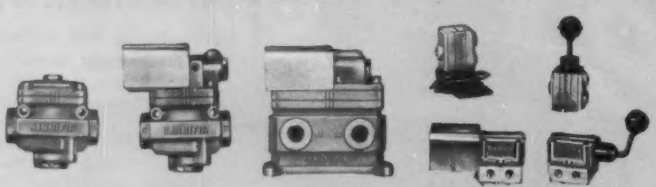
HANNIFIN AIR CONTROLS

Hannifin has the most complete line of air control valves. Exclusive designs, many types, for hand, foot, cam or solenoid control of air cylinders, presses, and other air-operated equipment. Ask for recommendations.



DISC-TYPE VALVES

Bronze discs lapped to perfect seal with seats. Packless design. For hand, foot or electrical operation.



P-M PILOT-MASTER VALVES

The P-M line provides faster, easier operation for the simplest to the most complicated air-operated circuit. 2-Way, 3-Way and 4-Way Master Valves and Solenoid Pilot-Master Valves . . . also direct operated 3-Way and 4-Way valves with a wide choice of operating heads.

WRITE FOR CONTROL VALVES CATALOG

The complete air controls catalog! Write for your copy today.

HANNIFIN

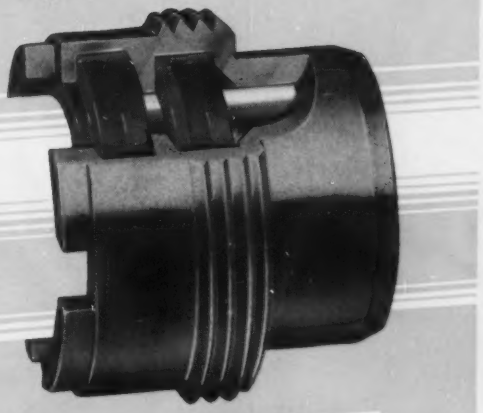
Hannifin Corporation, 509 South Wolf Road, Des Plaines, Illinois

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

TYPE CYLINDERS

BOTH WITH NEW, CARTRIDGE GLAND

...externally removable and replaceable without dismantling cylinder!

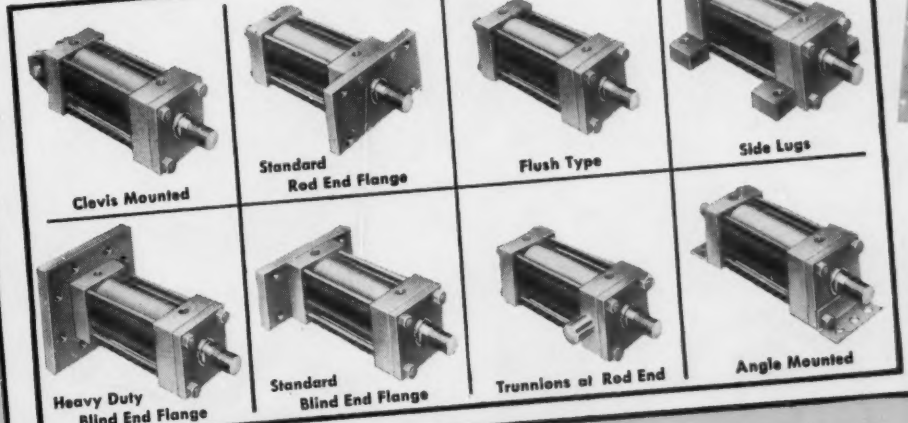


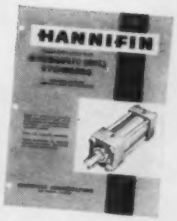
Here's the biggest improvement in cylinder design in the last 50 years. This exclusive Hannifin gland is a bronze cartridge, externally removable and replaceable as a unit to meet J.I.C. recommendations. A face type spanner wrench is the only tool you need. Now look at the packing! The "Wiperseal" serves a dual purpose as it wipes both ways to provide a dry rod on the out-stroke, a dirt-free rod on the in-stroke. The "Lipseal" is self-compensating, self-relieving and non-adjustable... provides an efficient seal throughout its long life. Ask for a demonstration... every Hannifin man carries a cutaway sample of this "jewel" of a gland with him at all times.

SERIES "H" HYDRAULIC CYLINDERS

Made in 9 bore sizes from 1½" to 8"... 13 standard mountings... many combination mountings. Extremely close tolerances for easy mounting. Heavy-duty tie rods. Steel heads. Steel cylinder bodies "Tru-Bored" and honed to a satin finish. Piston rods ground and polished then hard chrome plated for minimum friction and long packing life.

TYPICAL MOUNTING STYLES





WRITE FOR BULLETIN 113

Get your copy of this complete, easy-to-use catalog today. Everything you need to order from is here.

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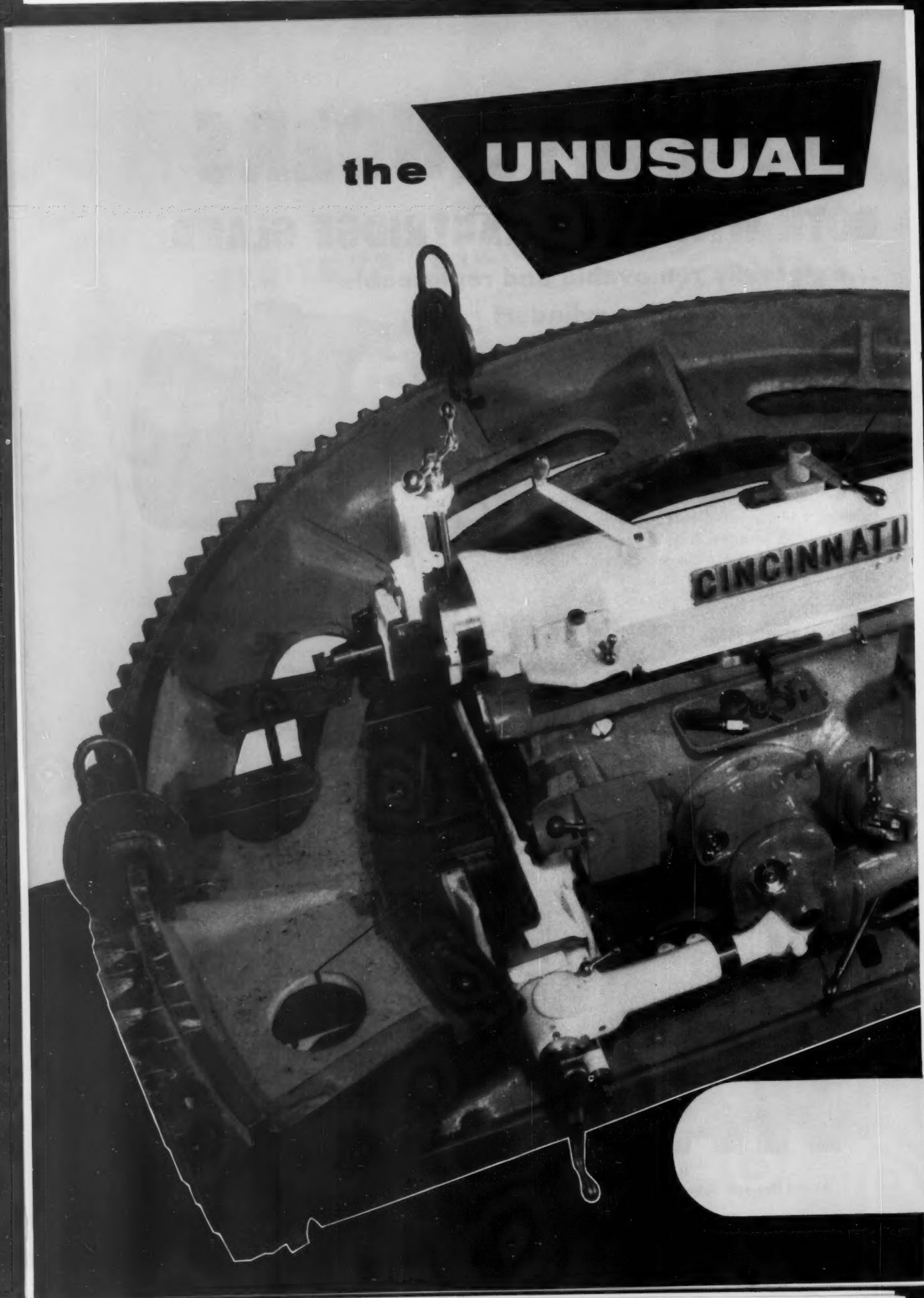
Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves


the UNUSUAL
CINCINNATI

is NORMAL for CINCINNATI SHAPERS

Stress relieving this massive gear required unusual rigidity of table and cross slide, and accurate starting and stopping of the shaper.

Some money making Cincinnati features:

- Electro-Magnetic Clutch and Brake.
- 50 P.S.I. automatic lubrication.
- Full control of all machine functions at operator's position.
- Solid, extended ram ways and many other features.

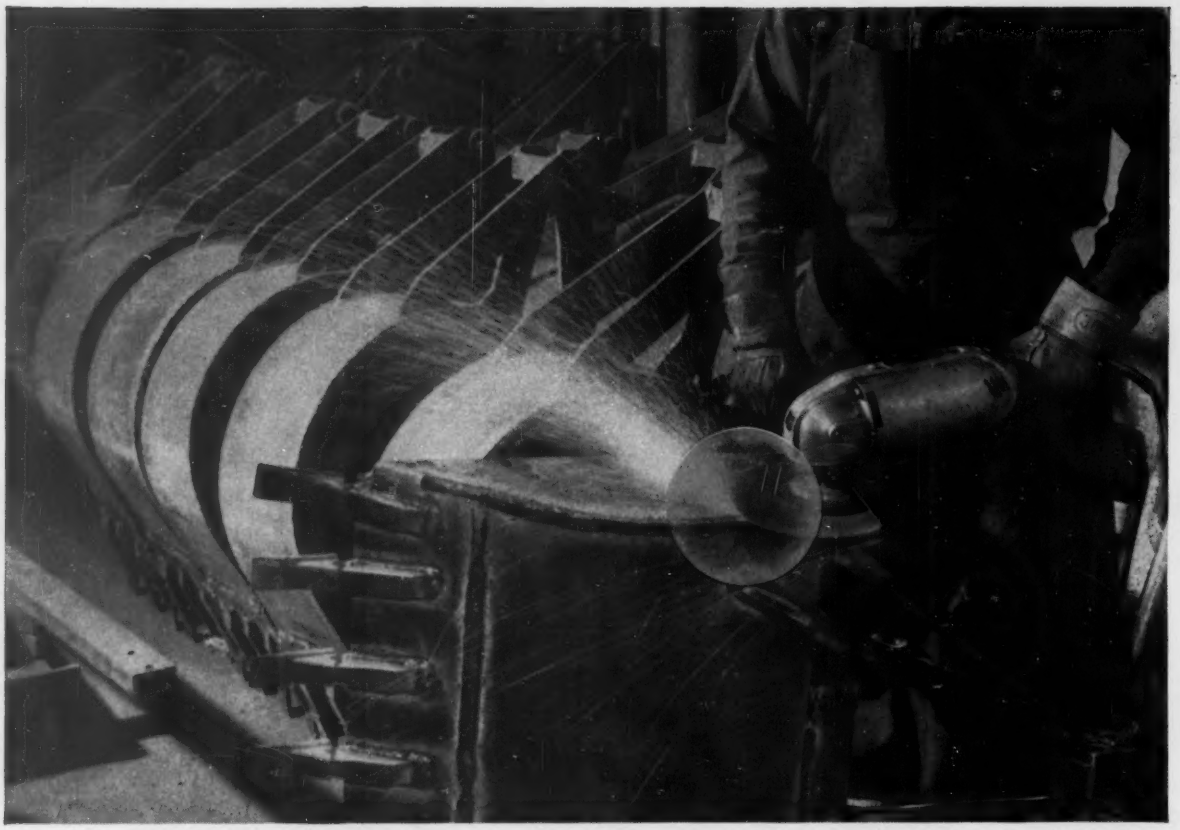
Write for Catalog N-6.

Photos courtesy Couer d'Alene Hardware & Foundry Company, Wallace, Idaho.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI



The BD is the preferred hub-type wheel for heavier stock removal. Ideal for smoothing and blending welds on fabricated work; smoothing flame-cut edges and stainless steel welds; cleaning between teeth of gear castings; many slotting, notching and cutting-off operations.

4 Great Team-Mates for your "TOUCH of GOLD"

Norton REINFORCED WHEELS add value, cut costs, on hundreds of grinding jobs

Here's The Line-Up

BD Rigid hub-type, resinoid bonded. Glass cloth reinforcement for high strength plus the Nylon layer add up to extra hub-wheel safety. For the more severe jobs on your right angle grinders.

BFR Semi-flexible hub-type, resinoid bonded. Cotton fabric reinforcement with the additional layer of Nylon. For better finish and contour blending.

BF Semi-flexible straight wheel, resinoid bonded. Cotton fabric construction similar to the BFR but without Nylon reinforcement. For periphery grinding only. An excellent deburring and finishing wheel. Also available in mounted wheels and points and in hand sticks.

BN Straight wheel, resinoid bonded. Glass cloth reinforcement, as in the BD. Provides very high resistance to breakage in a wide range of cutting-off and other jobs.

Add outstanding versatility to strength and to safety, multiply the result by four and you have one reason why this Norton team rates as the "Big 4" among reinforced wheels.

Separately, each handles a considerable number of important grinding jobs. Together, they cover an almost endless list of applications, ranging from light deburring to severe cutting-off. And they do every one of these jobs with the *extra* safety, service life and economy that add the real "Touch of Gold" to your grinding operations.

Your Norton Distributor

will be glad to demonstrate Norton Reinforced Wheels in your shop, and to aid you in any grinding problem. Or write to NORTON COMPANY, Worcester 6, Mass. for the Brand New Catalog on Reinforced Wheels. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts. W-1551

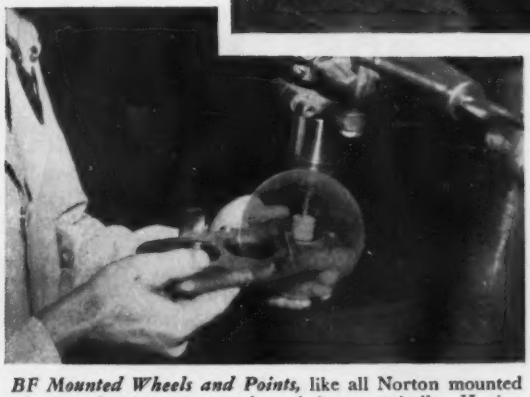
NORTON
ABRASIVES

Making better products... to make other products better

The BFR is outstanding for light snagging, light weld grinding, smooth finishing, blending contours and corners, removing mold marks, removing rust and scale; and scarfing and beveling before welding. Also for notching gates and risers.

The BF, a straight wheel version of the BFR, is the wheel to use for light deburring, breaking edges on machined work, taking off flash from plastic parts, removing light welds and many other miscellaneous light portable and bench grinding applications.

The BN is the recommended cut-off wheel wherever great strength and safety are vital. Excels at cutting-off non-ferrous gates and risers and various non-metals. Its range also includes cutting wire rope, slotting rails, tuck pointing, etc. Small sizes are popular on small portable grinders.



BF Mounted Wheels and Points, like all Norton mounted wheels and points, are trued on their own spindles. Having the same laminated construction as the larger BF wheels, they are designed for such jobs as finishing plastic molds, glass molds, forging dies, etc. For hand finishing, use BF sticks.

DANLY

A line of Danly Presses in a contract stamping shop

This line will turn out more finished stampings per shift, will set new production records in both cost and time savings.

Finished Stampings

COST LESS ON A DANLY LINE

You get more finished stampings per shift with a line of Danly Presses. Each Danly Press maintains steady, uninterrupted production. Running together as a line, they turn out more stampings because there are fewer line shutdowns.

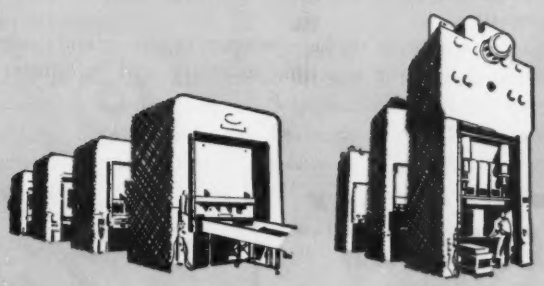
Danly's heavier construction is your best insurance against costly shutdowns. Also, look for complete automatic lubrication supplying clean filtered oil to gears, bearings and gibs; extra rigidity to minimize deflection and vibration, increase die life; exclusive electrical and pneumatic control devices for convenient automation and safer operation; cooler running, longer-wearing clutch and brake. From bed to crown, every Danly press is engineered for dependable performance.

That's why Danly Presses are setting new standards for operating efficiency—in many of the country's leading stamping plants. Danly press engineers are at your service . . . write today to have them give detailed attention to your specific stamping problem.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois

A line of Danly Underdrive Presses in a mass production plant

The dependability of each Danly Press is a vital factor in the production efficiency of automated lines like the one shown here.



Danly offers any press you need . . . single, double or triple action . . . overdrive or underdrive. Make your press line a Danly line and save costs at every stage of your operation from blanking to finished stampings.

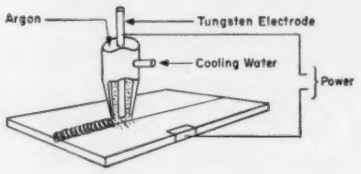
DANLY

3 Modern Methods

BOOST...

- Production
- Profits
- Quality

Whatever your fabricating needs—in small shops or on production lines, on carbon steel, complex alloys or non-ferrous materials—LINDE has a high-speed, cost-saving electric welding process for every job. Here is the line-up of this top-notch team...



HELIARC Welding—*ideal for metals .020 in. and thicker*... Joins all commercial metals in easy operations—attains speeds over 100 inches per minute . . . Welding is done in all positions on all types of joints with portable manual, semi-automatic, and mechanized equipment.

There is no slag, spatter, or smoke—the operator can see and control the weld puddle at all times. Weld finishing is seldom necessary, and investment and maintenance costs are low.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
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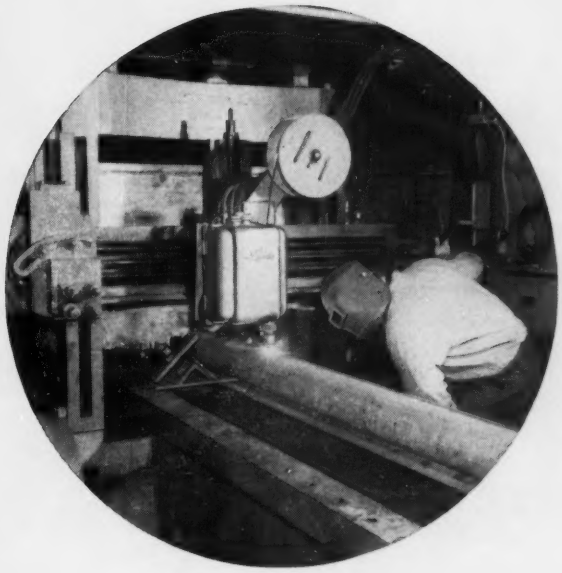
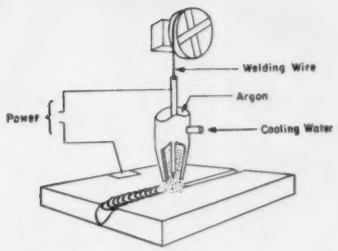
In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited, Toronto

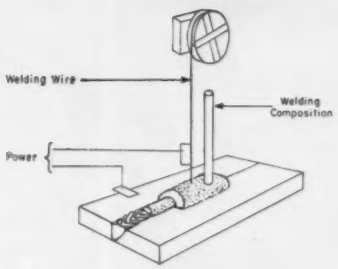
The terms "Heliarc," "Linde," and "Unionmelt" are registered trade-marks of Union Carbide and Carbon Corporation.

Linde Trade-Mark

For Joining Metals.....







Sigma Welding—*4 times faster wire deposition than by manual rod feed methods* . . . Full penetration up to ¼-in. in a single pass . . . Joins all commercial metals —and attains speeds of more than 100 inches per minute on many operations.

Uses any d.c., or c.p. (constant potential) power supply. With c.p., an operator has only to set the wire feed rate—current remains essentially constant throughout welding. Both manual and automatic mechanized sigma welding equipment is easy to operate and maintain.

UNIONMELT Welding—*joins metal of any thickness . . . Up to 3-in. thick in one pass.* Extreme depth of penetration and high rate of wire feed make this the fastest and usually the most economical of all welding processes. Deep penetration or wide shallow beads are easily attained by UNIONMELT welding.

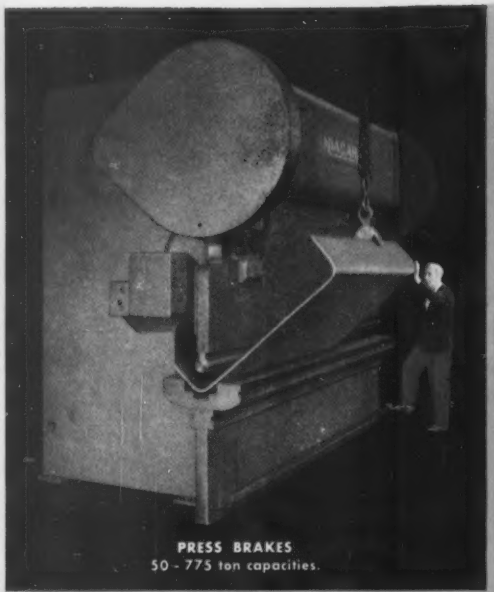
Both portable manual and mechanized setups are available, and can use any a.c., d.c., or c.p. (constant potential) power supply. With c.p., no control is necessary to maintain constant arc voltage throughout welding.

Start Saving Now — Call Your Local LINDE Representative Today . . .

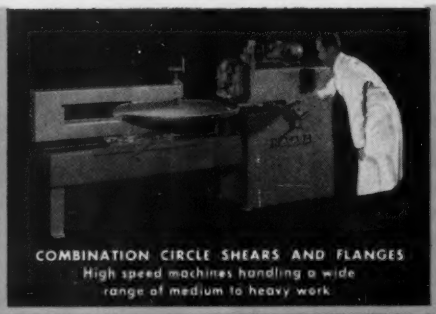
Ask for Form 7942, "Modern Methods of Joining Metals."

In plate or sheet metalworking...

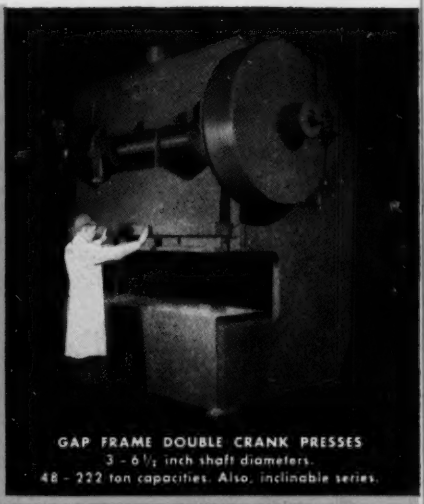
NIAGARA MACHINES CAN



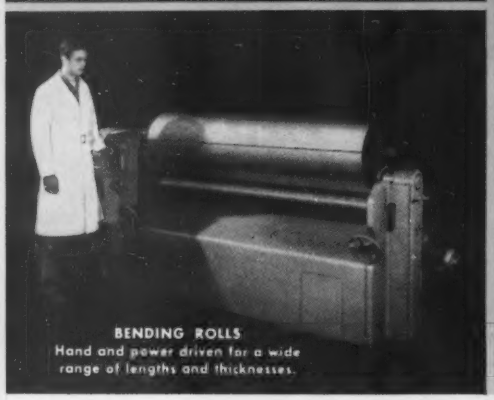
PRESS BRAKES
50 - 775 ton capacities.



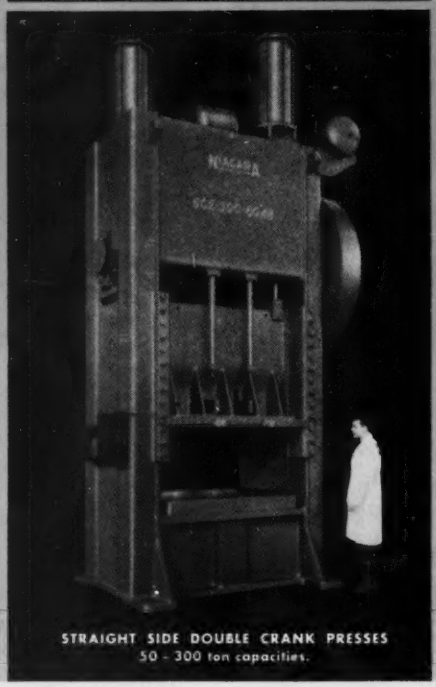
COMBINATION CIRCLE SHEARS AND FLANGES
High speed machines handling a wide range of medium to heavy work.



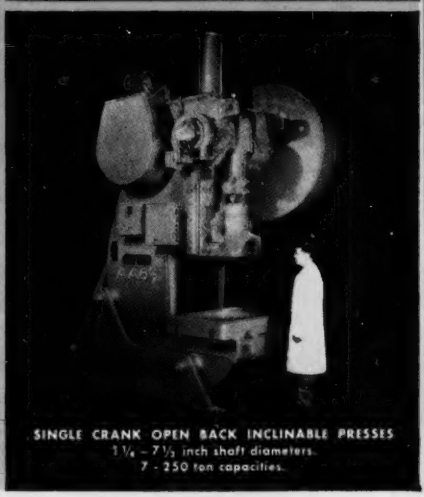
GAP FRAME DOUBLE CRANK PRESSES
3 - 6½ inch shaft diameters.
48 - 222 ton capacities. Also, inclinable series.



BENDING ROLLS
Hand and power driven for a wide range of lengths and thicknesses.



STRAIGHT SIDE DOUBLE CRANK PRESSES
50 - 300 ton capacities.



SINGLE CRANK OPEN BACK INCLINABLE PRESSES
1¼ - 7½ inch shaft diameters.
7 - 250 ton capacities.

NIAGARA

America's most complete line of presses, shears, machines and

DRUM MAKING EQUIPMENT

ELECTRONIC AUTOMATIC WELDER

FOLDER — BRAKES
- Adjustable Bar Folders
- Universal Folders and Brakes

GROOVERS and SEAMERS

HAND or FOOT OPERATED SHEARS
- Circle Shears
- Foot Curved Shears
- Foot Gap Shears
- Foot Squaring Shears
- Ring Shears
- Rotary Slitting Shears

HAND TOOLS
- Bench Plates
- Bench Shears
- Hammers
- Hand Groovers
- Hollow Punches
- Rivet Sets
- Snips
- Stakes

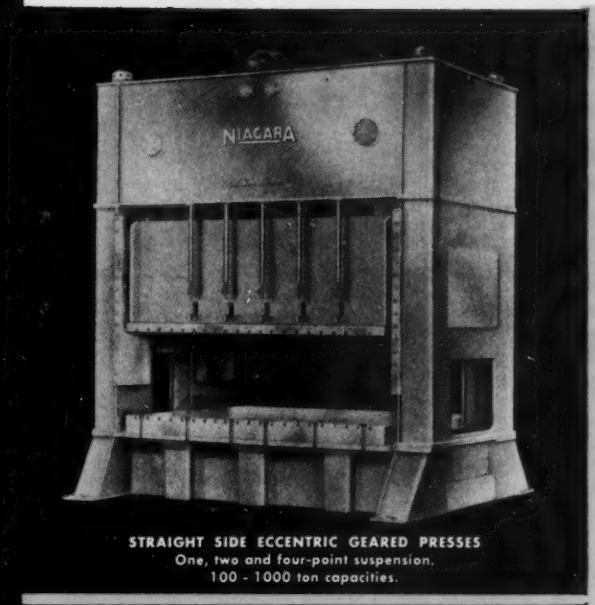
LEVER SHEARS and PUNCHES
- Bar and Rod Cutters
- Combination Lever Punches and Shears
- Lever Punches
- Lever Shears
- Notchers

POWER PRESSES
- Bench Presses
- Foot Presses
- Gap Frame Double Crank Presses
- Gap Frame Single Crank Presses
- Horn Presses — Side Seamers
- Hydraulic Presses
- Inclinable Gap Frame Double Crank Presses
- Inclinable Presses
- Straight Side Double Crank Presses
- Straight Side Eccentric Geared Presses
- Straight Side Single Crank Presses

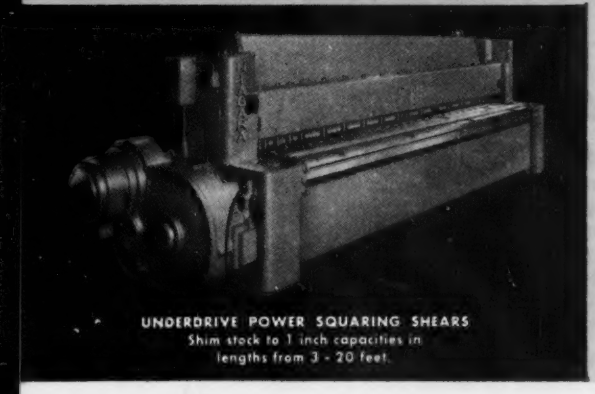
POWER PRESS BRAKES

POWER SQUARING SHEARS
- Economy Line Power Squaring Shears (14 Gage Max.)
- Gap Frame Overdrive Power Squaring Shears
- Light Gage High Speed Power Squaring Shears
- Underdrive Precision Type Heavy Duty Power Shears

DO THE MOST FOR YOU



STRAIGHT SIDE ECCENTRIC GEARED PRESSES
One, two and four-point suspension.
100 - 1000 ton capacities.



UNDERDRIVE POWER SQUARING SHEARS
Shim stock to 1 inch capacities in lengths from 3 - 20 feet.

MOST EXTENSIVE LINE:

From giant, power-operated machinery to small hand tools

MOST ADVANCED DESIGNS:

Years ahead in performance through forward-thinking engineering

In the world's largest automotive and appliance plants or the smallest of sheet metal shops, Niagara machines and tools are usually at work "in force."

Batteries of giant presses are teamed up with speedy ring and circle shears. Massive, rugged press brakes stand side-by-side with powerful bending rolls and squaring shears. Versatile lever punches, rotary machines, groovers and seamers . . . all operate together to produce a better product at lower cost. The Niagara lines are "companion lines" of metalworking machines and tools that work together. A Niagara-equipped shop or plant is years ahead in quality and volume of production.

Whatever you require — power presses or hand tools — Niagara is the line that can do the most for you. It is the most complete in the industry . . . the most advanced in engineering. You can consult a Niagara representative with complete confidence of unbiased recommendations. Niagara has the right machines and tools for your requirements.

tools for plate and sheet metal work

NIAGARA MACHINE & TOOL WORKS 1879 75 1954

POWER ROTARY SHEARS
- Power Circle Shears
- Power Circle Shears and Flangers
- Power Ring and Circle Shears

ROTARY MACHINES
- Bending
- Burring
- Combination Machines
- Corrugating
- Crimping
- Edging
- Flanging
- Forming and Curving Machines
- Multi-Drive Table for Rotary Machines
- Setting Down Machines
- Turning
- Wiring

SLIP ROLL FORMERS
- Hand and Power Machines

BRING YOUR FILES UP-TO-DATE WITH INFORMATIVE NIAGARA BULLETINS

Listed at the left are the diversified machines and tools that make up the famous Niagara line. Be sure that you have the latest data on the ones that apply to your type of work. At your request, specific Niagara Bulletins will be mailed promptly, without obligating you.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

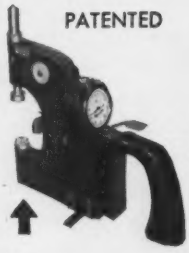
DISTRICT OFFICES:
Buffalo • Cleveland • Detroit • New York • Philadelphia
Dealers in principal U. S. cities and major foreign countries

EFFECTIVE- EFFICIENT* aye, and ECONOMICAL, too!

PARALLOC Dial Snap Gages

With a remarkable new type of pin locking mechanism that minimizes "out-of-parallelism" between anvil faces. "L" Type fully encased, with set-back indicator and handle, permitting entry into narrow recesses. Wide choice of indicators as for "D" Type.

PATENTED



"L" (LEVER) TYPE

8 SIZES, each with ½" range, cover over-all range 0" to 4"

"D" (DIRECT) TYPE

8 SIZES, each with 1" range, cover over-all range 0" to 8"

DIAL Bore Gages

10 SIZES

cover range from

1/8" to 24"

PATENT APPLIED FOR

Three new models extend dial bore gaging range by intermediate steps down to ⅛" diameter. Each utilizes STANDARD's new, highly practical CENTERING-SIZE DISC principle. Simple in design, easy to set, easy to use; amazingly accurate and effective in small bore gaging.

DuBo® Plug Gages

PATENTED

Whether handle will drop freely or not shows "Go" or "NoGo". Finger-tip operation reveals internal bore conditions by sensitive "feel". Tells more, more easily, than ordinary plug gages.

SINGLE END
Sizes over 1.510"

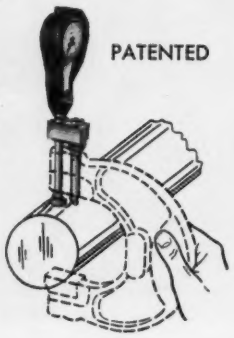
DOUBLE END
Sizes under 1.510"

Dializers®

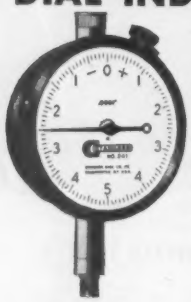
STANDARD's original device for converting AGD Adjustable Limit Snap Gages to *DIAL* Snap Gages. Wide range of indicators from 1⅛" to 2¼" diameter, graduations of .001", .0001", .0005" and .00025", and a wide variety of dial markings, including metric.

Available separately for your frames or assembled in AGD frames supplied by us.

PATENTED



DIAL INDICATORS*



A complete range of sizes and mountings, with any desired graduation; regular, metric or Decimatic . . . all completely shockproof.

EFFICIENCY
- EASE OF HANDLING
- EASE OF READING
- LONG SERVICE LIFE
- REDUCTION OF FALSE REJECTS

Write for "NEWS"; get full details of new STANDARD instruments that speed production and save you time, money and worry.

STANDARD Gage Co., Inc.
Poughkeepsie, N.Y.

For more information on products advertised, use Inquiry Card, page 255

a statement from

PROCTOR AND SCHWARTZ, INC.

on

Machinery Replacement

"At Proctor & Schwartz, the replacement problems fall into two main classes. The first class is equipment which leans toward obsolescence. The second class deals with equipment which cannot maintain quality production. We use the "Rate of Return on Average Net Investment Method" to determine the advisability of replacing or procuring new capital equipment. A description of this method may be found in the Corporate Treasurer's and Controller's Handbook.

"In each replacement case, a detailed investigation is made by the Methods Department. The Cost, Standards, and other departments co-operate by supplying the necessary information. These investigations follow the same pattern and in each case the Rate of Return is calculated. A comparison is made between repair, overhaul, and replacement. By using the same method, we feel that we can accurately compare the possible solution to the problem being considered.

"Based on the results of the investigation, a detailed report is presented to the Executive Committee. This report presents the problem, various solutions, and the solution recommended. The final decision as to replacement is made by the Executive Committee, using the justification report as a guide. This decision may be affected by business conditions, etc.

"A file of all justification reports is maintained so that comparison may be made with any machine already investigated. This enables the committee to plan the purchase of new equipment with a sound basis. Gone are the days when replacement was a guess, hunch, or shot in the dark."

W. W. SIBSON, JR.
Vice President

January, 1955

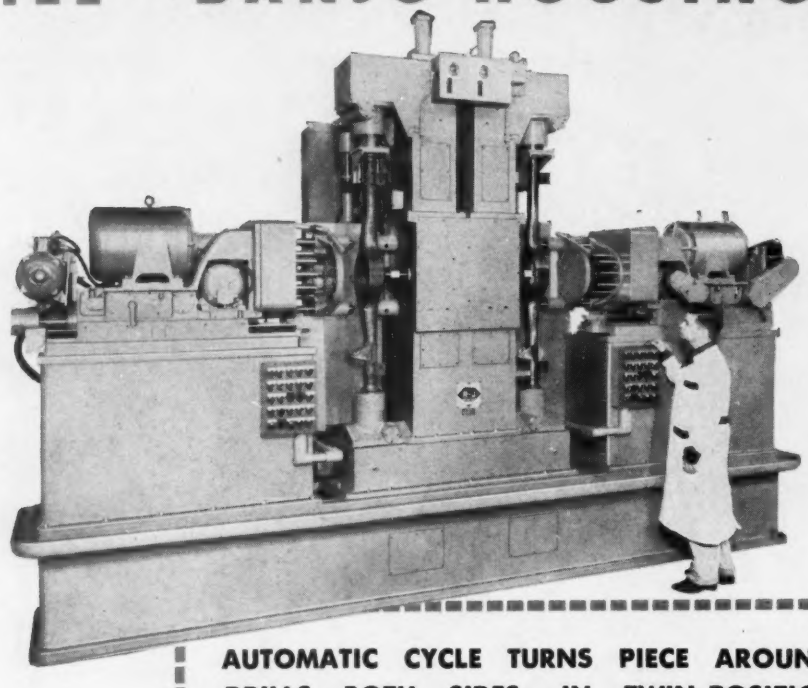
ROCKFORD INSERT GROUP

Keep Gathering Metal-Working Production Ideas . . . Be Well Informed When The Time For Replacement Arrives . . . . .

REHNBERG-JACOBSON

Shows the way to...

DRILL "BANJO HOUSINGS"



AUTOMATIC CYCLE TURNS PIECE AROUND, DRILLS BOTH SIDES, IN TWIN-POSITION MACHINE . . .

There are ten 0.328″ holes to be drilled in each side of the center ring of this Rear Axle Housing for a prominent line of automobiles. The machine above shows a way to do this operation that is a distinct advance over the method formerly employed. The operator tends the two duplicate positions alternately. The piece is automatically centered from the two finished ends by an equalizing fixture, then automatically squared to the drills by a backing bar. When one side is finished, the piece is automatically rotated and again squared for the second operation. Drilling units are ALL-MECHANICAL; work-positioning, rotation, and re-locating by air cylinders. Rated capacity is 100 pieces per hour. *Try Rehnberg-Jacobson for the possibility of an ingenious solution of YOUR production problems.*

Designers and Builders of Special Machinery

REHNBERG-JACOBSON MANUFACTURING COMPANY

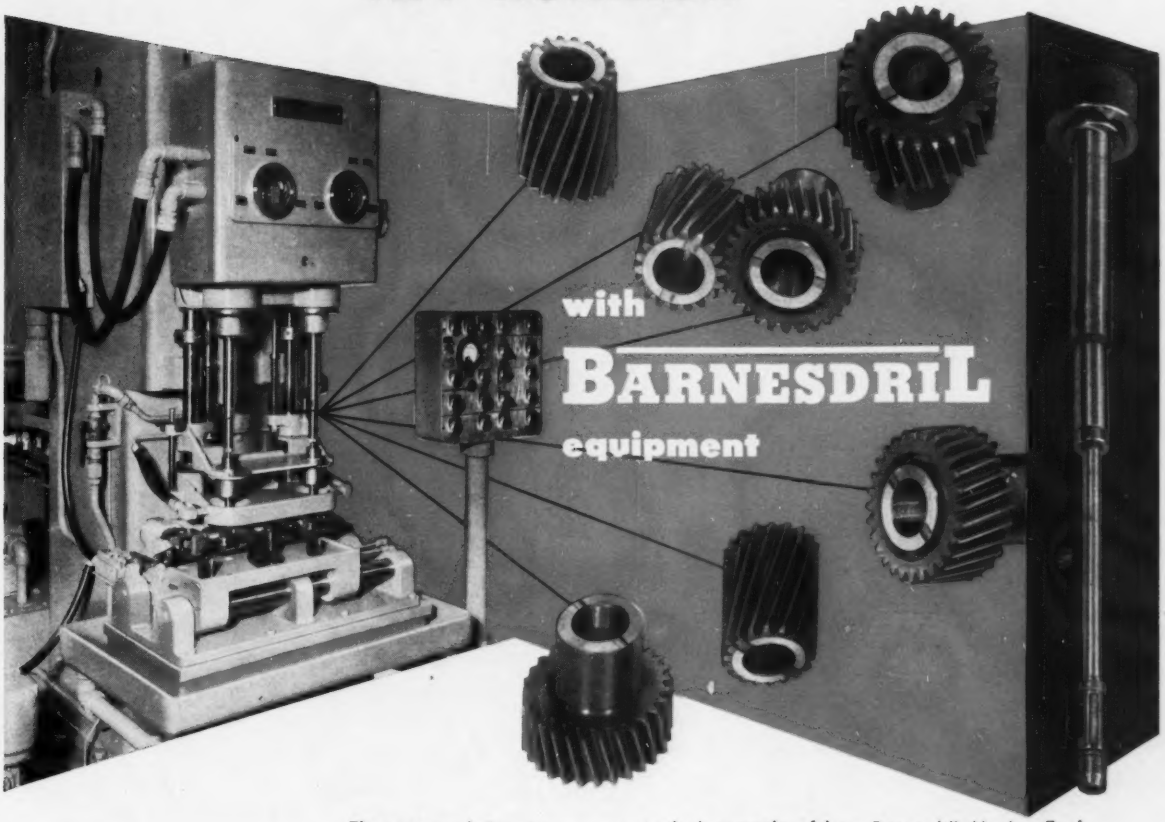
2135 KISHWAUKEE ST.

ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

when the HOLE business is a problem

TRY HONING..

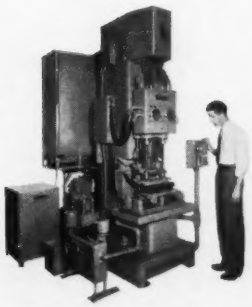


CONTROLLED ACCURACY

CONTROLLED FINISH

These transmission gears are a typical example of how Barnesdril Honing Engineering simplifies the hole finishing process and supplies accuracy and finish control. Completely automatic control provides bore-to-bore accuracy within .0005", stock removal of .0025", and 10 R.M.S. finish.

Electronic Hone Expansion on this No. 223 2-spindle Honing Machine maintains proper pressure between the stone and work for maximum rate of stock removal, with controlled geometric accuracy of roundness and taper. Because the stone is supported at the cutting edge with controlled feed pressure, longer abrasive life results, with less downtime on the machine for stone replacement.



Plugmatic Sizing provides the most accurate sizing method available, sizing the bore directly with a positive gage. The sizing member cannot be affected by either misalignment or eccentric stone wear, accounting for complete interchangeability of parts finished.

When you have a hole finishing problem, call your Barnesdril representative, or write . . .

HOLE BARNESDRIL FINISHING

BARNES DRILL CO.

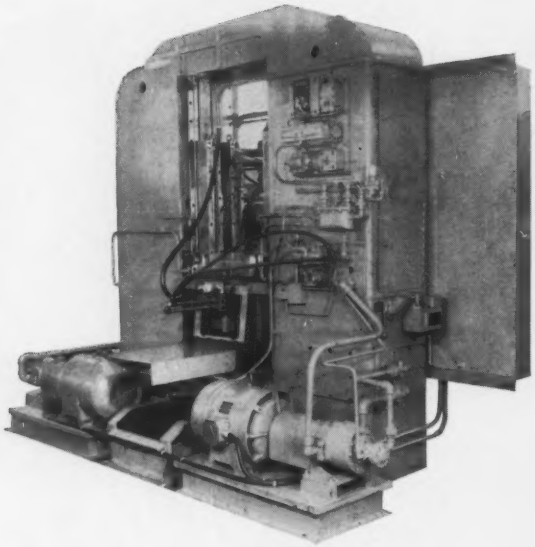
820 CHESTNUT STREET • ROCKFORD, ILLINOIS

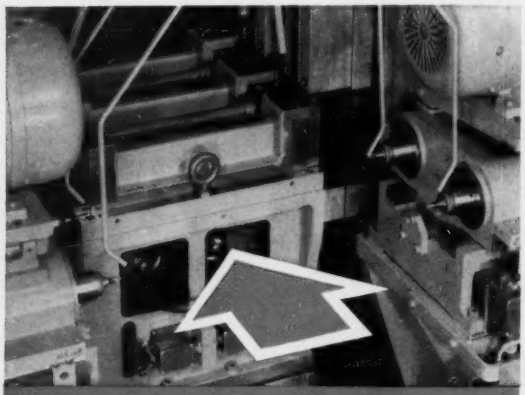
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

ANOTHER *American* FIRST

COMBINED BROACHING and CENTER DRILLING

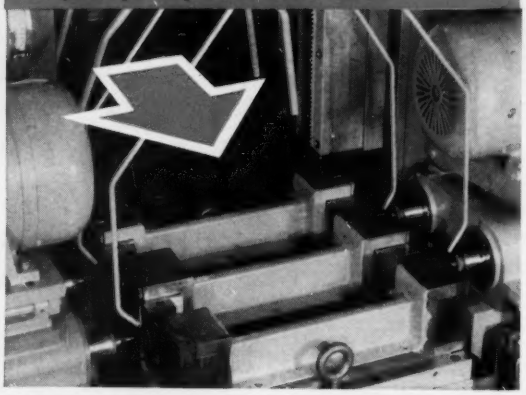
PRODUCTION:
OVER 300 TRANSMISSION SHAFTS PER HOUR





Two parts are automatically clamped and shuttled into broaching position by hydraulic slide. Surface broach sections mounted on the two rams move down to broach approximately ¼" of stock from each end of forged parts.

While the rams return, the slide moves back, positioning parts for center drilling of both ends. Drills move in, after which parts are automatically unclamped. Complete cycle is push button controlled.



Here, in one machine, American has combined two operations — broaching and center drilling of both ends of automotive main transmission shaft forgings, two at a time.

Two standard vertical hydraulic broaching machines were adapted to a common center table that is equipped with a hydraulically operated slide and two-station clamping fixture. Parts are automatically clamped in place, shuttled into the broaching and drilling positions, and unclamped — with the entire cycle being interlocked with electrical controls.

American engineers will be happy to recommend the broaching equipment either special or standard, that is best for your operation. Send sample part or detailed drawing. Your requirements will get prompt attention.

Write for Catalog No. 450, American's revised informative manual of broaching machines, broaches and fixtures.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

SUNDSTRAND

American Building - Ann Arbor, Michigan

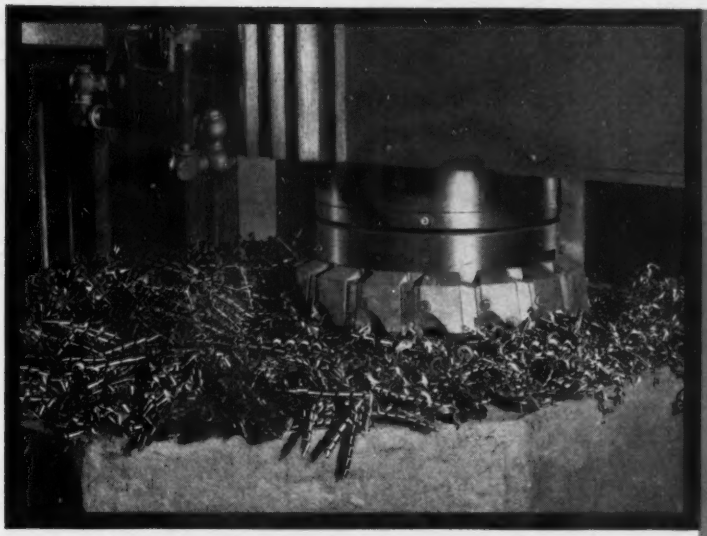
See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

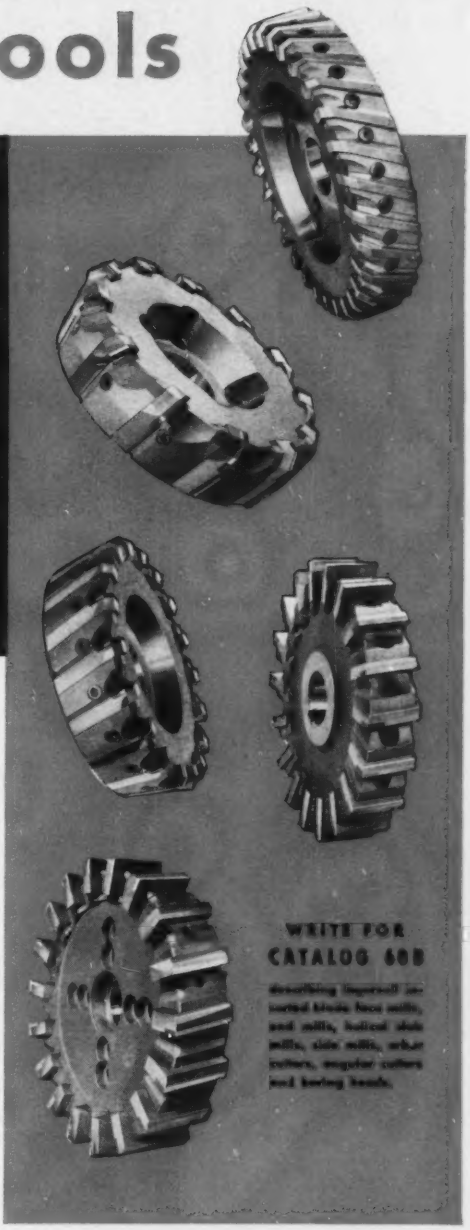
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Fill Your Exact Cutting Needs with

INGERSOLL

Cutting Tools





Whatever your particular milling and boring operations, there are Ingersoll inserted blade cutting tools to meet your specific requirements.

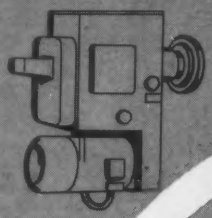
The largest manufacturer of inserted blade cutters, Ingersoll can give you prompt delivery of its many standard types and styles of milling and boring tools. Forty-two styles of Shear Clear Face Mills, NX Face Mills and half side mills, from 4″ to 12″ in diameter, are kept in stock for immediate shipment. In stock, too, are 129 varieties of long-life replacement blades. Ingersoll also manufactures special cutters which are individually designed for complex or unusual cutting problems.

Take advantage of Ingersoll's 65 years of experience by asking Ingersoll cutter engineers to study your work and recommend cutting tools for your individual production needs.

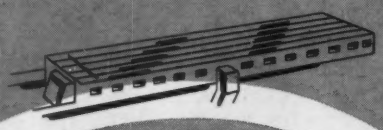
THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U. S. A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS

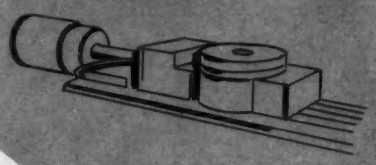
FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



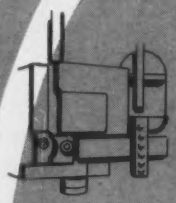
HORIZONTAL HEADS
Available in capacities from 3 to 100 HP.



HORIZONTAL TABLES
Available in widths from 10½" to 48" and feed strokes from 18" to 216".

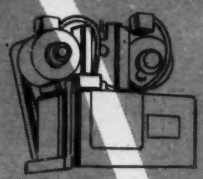


INDEX BASES
Easily applied to standard Rigidmils for increased production by the elimination of loading time or improvement in accuracy by the machining of multiple surfaces with one handling of the work piece.

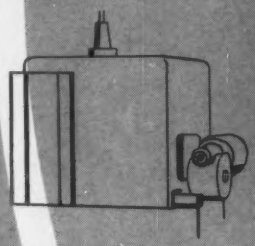


VERTICAL HEADS
Available in capacities from 7½ to 50 HP.

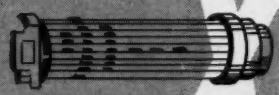
From These Elements...It's Easy To Get What You Want From SUNDSTRAND



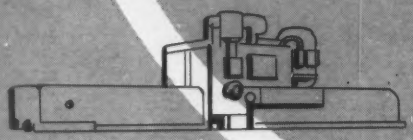
VERTICAL FEED UNIT
This unit provides vertical feed and rapid traverse in combination with the table movement for square cycles, clearing obstructions on work piece, etc.



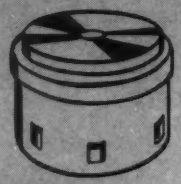
ADJUSTABLE COLUMNS
Movable columns provide maximum cutting rigidity for horizontal heads over a wider range for milling both large and small work pieces.



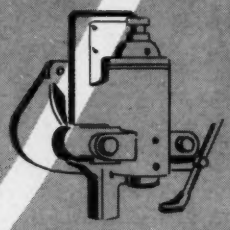
AUTOMATIC QUILL POSITIONING
Positions the cutter for multiple depths of cuts and provides automatic cutter relief.



RAIL TYPE HEAD
Way type rail provides extreme accuracy over wide range of adjustment for vertical spindle head.



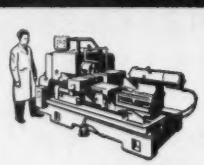
ROTARY TABLES
Available in several sizes for continuous or rotary milling operations.

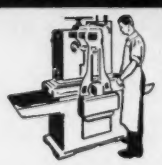


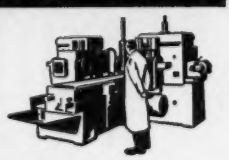
ATTACHED VERTICAL HEAD
Driven from horizontal spindle this attachment increases possible uses of standard Rigidmils.

SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS





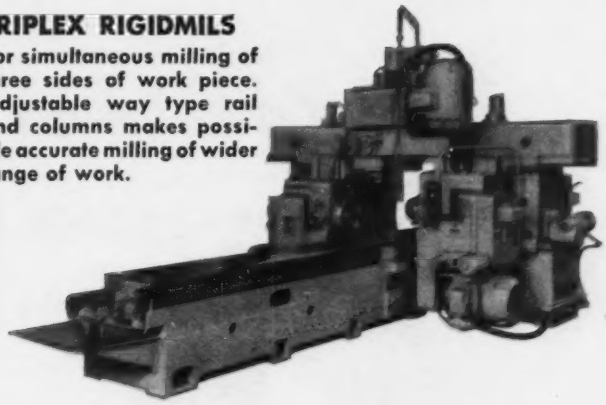


MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Sundstrand Rigidmils are built from standard machine elements as shown at the left. After the correct tooling for the job has been determined, the proper combination of machine elements is assembled to complete the machine, like or similar to the Rigidmils shown at the right. In this method of machine design and construction it is easy to obtain the proper equipment or machine to suit your work. You buy what you need . . . no more, and no less.

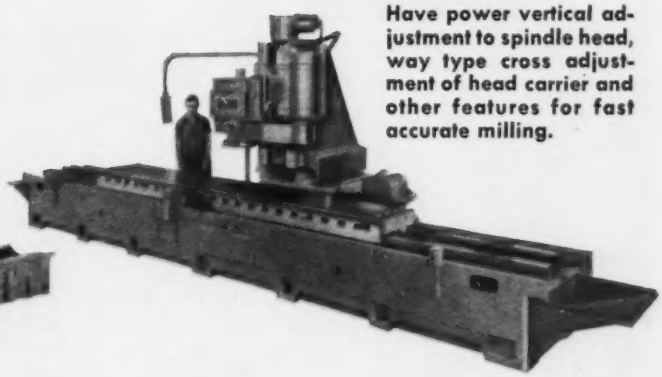
TRIPLEX RIGIDMILS

For simultaneous milling of three sides of work piece. Adjustable way type rail and columns makes possible accurate milling of wider range of work.



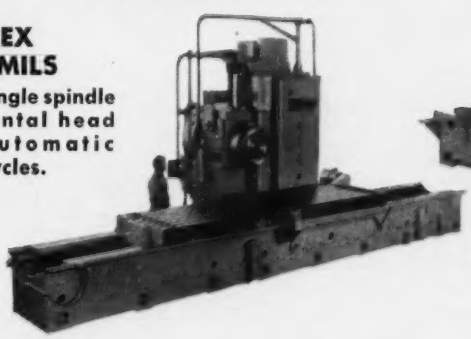
VERTICAL RIGIDMILS

Have power vertical adjustment to spindle head, way type cross adjustment of head carrier and other features for fast accurate milling.



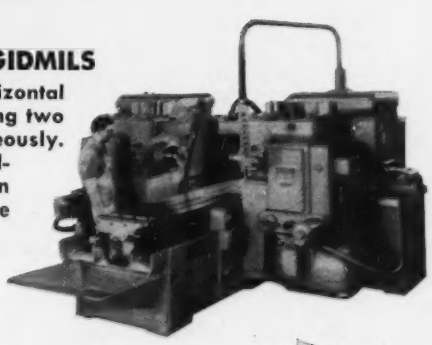
SIMPLEX RIGIDMILS

Have single spindle horizontal head and automatic table cycles.



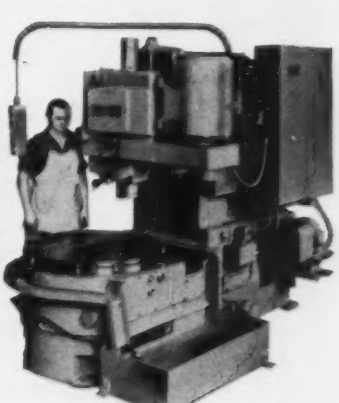
DUPLEX RIGIDMILS

Have two horizontal heads for milling two sides simultaneously. Adjustable column type shown has wider range between spindles.



ROTARY RIGIDMILS

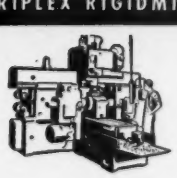
Have vertical spindle head, way type cross adjustment of spindle head carrier and rotary table for continuous or circular milling.

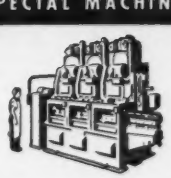


Get complete facts on the complete line of Sundstrand machine tools and "Engineered Production" service. Write for bulletin 651.

FREE DATA

TRIPLEX RIGIDMILS | SPECIAL MACHINES



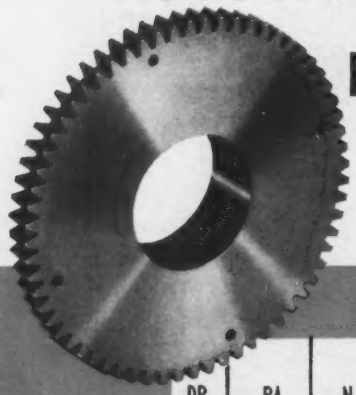


SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Barber-Colman

Precision Hobbing Machines



PROVIDE ACCURACY CONTROL

GEAR DATA CHART

GEAR DATA					MACHINE CONDITIONS		INSPECTION RESULTS		COMPARISON TO
DP	PA	N	D	Helix Angle	Hob Speed (RPM)	Feed ("/rev.)	Total Composite Error	Tooth-to-Tooth Composite Error	Agma Accuracy Classification
48	20°	192	4.000	0°	157	.005	.00025	.00005	Class 3 Prec.
48	14½°	128	2.672	3°39'LH	230	.010	.0003	.00015	Class 2 Prec.
64	20°	176	2.750	0°	309	.016	.00035	.0001	Class 1 Prec.
96	20°	64	.667	0°	309	.010	.0002	.0001	Class 2 Prec.
96	20°	16	.167	0°	133	.006	.0003	.0001	Class 2 Prec.
120	20°	21	.175	0°	133	.006	0003	.0001	Class 2 Prec.
32	20°	64	2.000	0°	183	.006	.0010	.0004	Class 1 Prec.

This precision gear manufacturer hobs gears in all of the precision classes shown in ASA B6.11-51, "Inspection of Fine-Pitch Gears". While the quantity of gears cut per production order is usually quite small, the methods used indicate the important elements which must be controlled in any precision gear cutting operation.

To obtain the finest accuracy, this plant uses Barber-Colman Precision No. 6-10 Hobbing Machines, in combination with Class AA ultra precision hobs. Precision Class 2 tolerances are held, and these results on fine pitches are generally considered the best obtainable. Only Class AA hobs are used for gears of this accuracy because any inaccuracies occurring in the hob will produce gear tooth profile errors which in turn contribute to tooth-to-tooth and total composite errors. These ultra precision hobs are maintained at peak accuracy by periodic precision sharpening on Barber-Colman sharpening machines, removing .005" stock or less, depending on pitch. Hobs are inspected after each sharpening to standard tolerances for Class AA hobs.

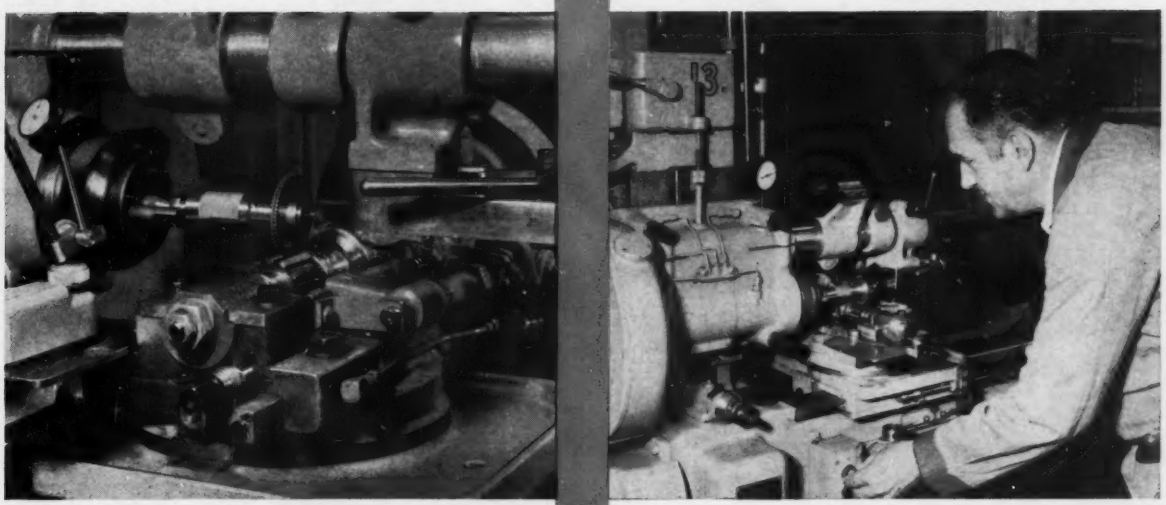
Prior to hobbing, all blanks are machined to precision tolerances. For all precision gears, squareness of the face with the bore, accuracy of the bore, and lateral runout

BUILDERS OF PRECISION GEAR

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Precision Class AA Hobs

NEEDED FOR PRECISION FINE PITCH GEARS



should be held to the standard tolerances for that particular class of gear. The blank must run true within these tolerances when it is mounted on the hobbing machine. For the utmost accuracy, gears are hobbed between centers. Prior to mounting the work, the line-up of the centers is checked with a test bar. Finished gears are rolled with a master gear or rack.

Using this general procedure for each precision gear, this plant produces gears of finest accuracy, as indicated in the table.

Although the degree of accuracy may vary in some applications, these methods and controls indicate some of the important elements which must be controlled.

If you require precision gears of the finest accuracy, you can meet the rigid specs with Barber-Colman hobs and equipment. For specific hob applications, write our engineers or call your Barber-Colman representative for full details.

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 621 ROCK STREET, ROCKFORD, ILL.

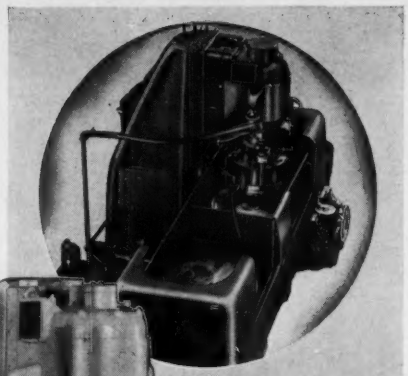
HOBS AND MACHINES SINCE 1911

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

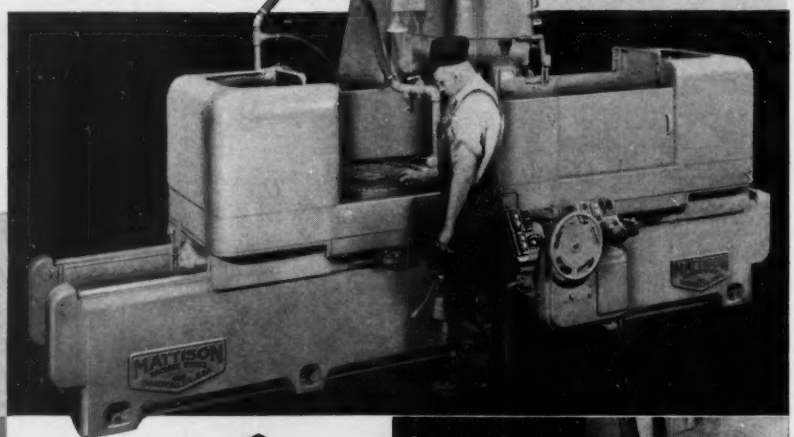
Downtime BECOMES *Production Time*

with the

NEW MATTISON DUPLEX



Take a look at **THIS**



~~2 Operators~~
~~2 Standard Grinders~~
~~500 Pieces~~

1 Operator
1 Mattison Duplex
500 Pieces

● That's what happened at The Ingersoll Milling Machine Co., where modern shop equipment is playing an important part in meeting greatly increased requirements for Ingersoll milling cutter blades.

They say "The pieces being ground in these pictures are Maxel steel shanks for carbide-tipped milling cutter blades.

On these particular blade shanks, .050 stock is removed on the Mattison Duplex. A wide variety of blades and shanks are ground on this machine, with stock removal ranging from .020 to .200.

The two Mattison Duplex machines which replaced three single-table standard type grinders are doing more work than the three replaced machines. By placing a single ring of blades around the outside of the 30″ diameter chuck, the operator is able to maintain continuous grinding. If more blades were put on the table at one time, the blades on the other table would be finished before he was ready to unload them.

The time saving in rough grinding these blades on the new Duplex machines is 50 per cent, compared with the old machines. In other words, 500 blades can be produced in half the time formerly required. Greater power and faster action account for some of this difference.

The new Mattison Duplex Grinder is really two machines in one, being equipped with two rotary tables or chucks instead of one. On many classes of work, one operator with this machine can turn out as much work as was formerly done by two machines and two operators. See example to the left. Downtime is practically eliminated.

An analysis of your grinding work will very likely disclose many jobs that could be very profitably handled on a Mattison Duplex. For further information write for a free copy of 145-3RM our new circular on this machine.

MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

ROCKFORD ECONOMY LATHES

now have ground, FLAME-HARDENED BEDWAYS

Rockford Economy Lathes now have flame-hardened and ground bedways, in addition to their features of power, weight and rigidity for high production; accuracy requirements for tool room work; and speeds for carbide tools.

Our new catalog No. 903 contains complete data and specifications. Ask a Rockford Machine Tool Co. representative for a copy, or write direct to

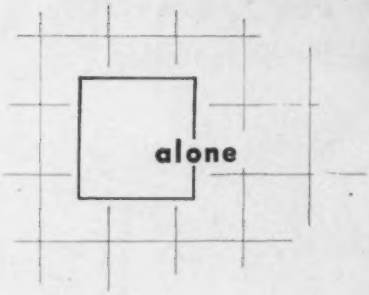
ROCKFORD ECONOMY LATHES

MEDIUM-SIZED
ECONOMY-PRICED

ROCKFORD MACHINE TOOL CO.

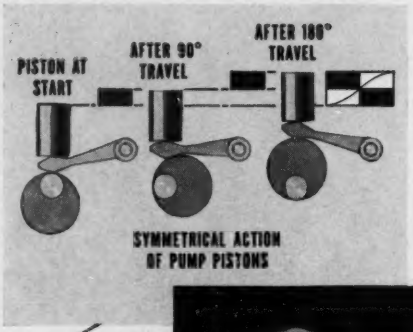
2500 KISHWAUKEE ST. • ROCKFORD, ILLINOIS

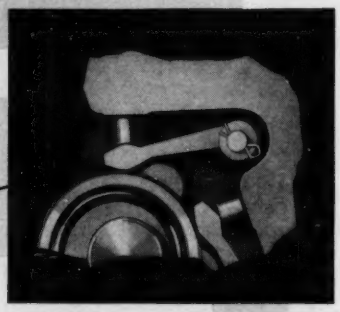
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

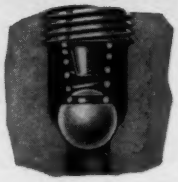


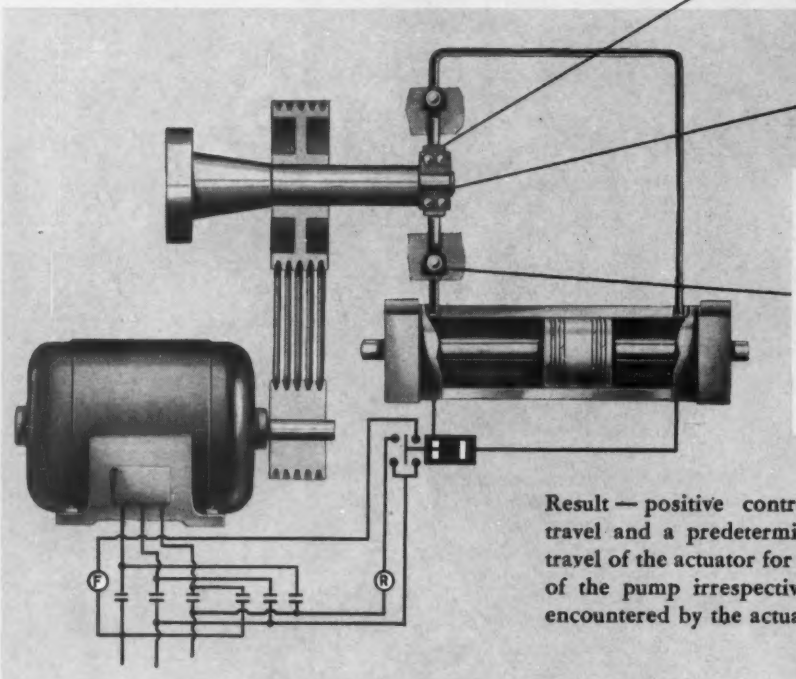
BARNES closed fluid circuit and control

Fluid circuit and power drive consist of an actuator; a variable displacement pump for propelling the actuator at selected speeds; sealed ducts leading from the actuator to the pump and from the pump to the actuator; electrical power means for rotating the pump in one direction or the other; and synchronous means for controlling the electrical power means.









Result — positive control of actuator travel and a predetermined amount of travel of the actuator for each revolution of the pump irrespective of resistance encountered by the actuator.

BRANCH OFFICES

503 New Center Building
Detroit 2, Michigan

3254 Lincoln Avenue
Chicago 13, Illinois

132 East Hanover Street
Trenton 8, New Jersey

SALES REPRESENTATIVES

Rees Machinery Company
1012 Empire Building
Pittsburgh 22, Pennsylvania

B. W. Rogers Company
850 South High Street
Akron 9, Ohio

Standard Machine & Tool Co.
870 Ottawa Street
Windsor, Ontario, Canada

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Anderson

STRAIGHTENING PRESS *for heavy work*

TAKES THE GUESS WORK OUT OF STRAIGHTENING

50 TON CAPACITY

With the ram at one end of the table, a crane can lower heavy work on the table, and the ram moved to where required. The ram rolls on four ball bearing equipped wheels and is easily moved by hand. The table has a "V" slide on which are mounted spring loaded centers and checking rolls. Length of bed and stroke length can be varied to meet customers' needs.

IMPROVED HAND SCRAPER

Anderson's Model 5 hand scraper is light in weight, easier to use with palm fitting comfort grip, and faster cutting. Three sizes: 18", 20", 22" long. Furnished with high speed steel or Carboloy Blades.

POWER SCRAPER has a "natural hand control" ... left hand serves as guide to the blade, and the right hand regulates the stroke. A slight forward pressure on cylinder with right hand starts swift, smooth forward stroke which can be regulated from nothing to 3½ feet ... 60 feet per minute, reverse speed 90 feet per minute. Has a ¼ H.P. motor, easily portable. Write for more information today.

ROCKFORD Anderson BROS. MFG. CO. ILLINOIS

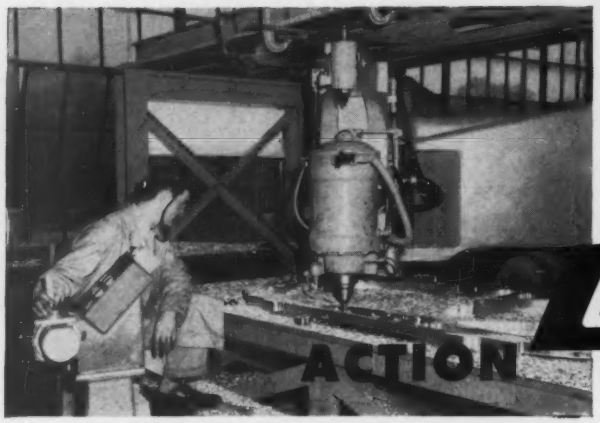
Send for Bulletin 5-6

ANDERSON BROS. MFG. CO.
1907 Kishwaukee St.
ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

MAKING THE CHIPS *FLY*

ON BIG MACHINED-FROM-SOLID ALUMINUM PARTS FOR AIRCRAFT

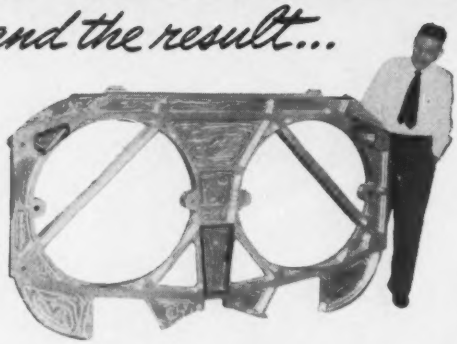


EKSTROM, CARLSON No. 400

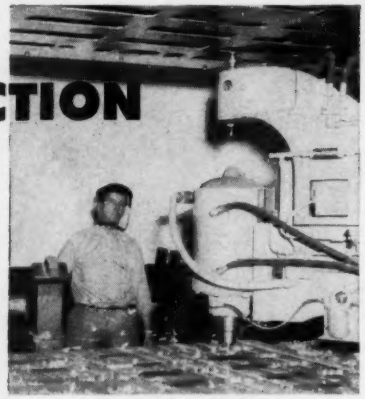
CAV-RO-MIL

This new machine is truly astonishing in its performance . . . those who have seen it in action have marveled at the cloud of chips it throws, at its accuracy, and at the extreme ease of operation. It is specially designed to meet the needs of today's . . . and tomorrow's . . . aircraft design and production.

and the result...



MORE ACTION



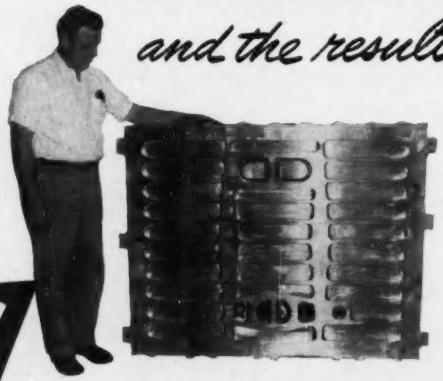
The cutter is driven at either 3600 rpm or 7200 rpm by a direct-connected hi-cycle motor in the head. Above the head is a retractable follower pin that engages the template attached to the "ceiling", to determine the travel of the head and production of the required cavities. The rigidity of the head and follower permits high-production milling within close tolerances.

CONTROLLED BY SIMPLE "JOY STICK"

Travel of the head in all directions and at variable speeds is entirely controlled by a single lever on the pedestal. Normal maximum traverse speed is 120 inches per minute. Both pieces shown were cavity milled and contoured and the lower piece was also skin milled. These parts are produced on this machine in 1/3 the time required by ordinary methods.
Write for further details.

EKSTROM, CARLSON & CO.
1400 RAILROAD AVE., DEPT. M 4
ROCKFORD, ILL.

and the result...

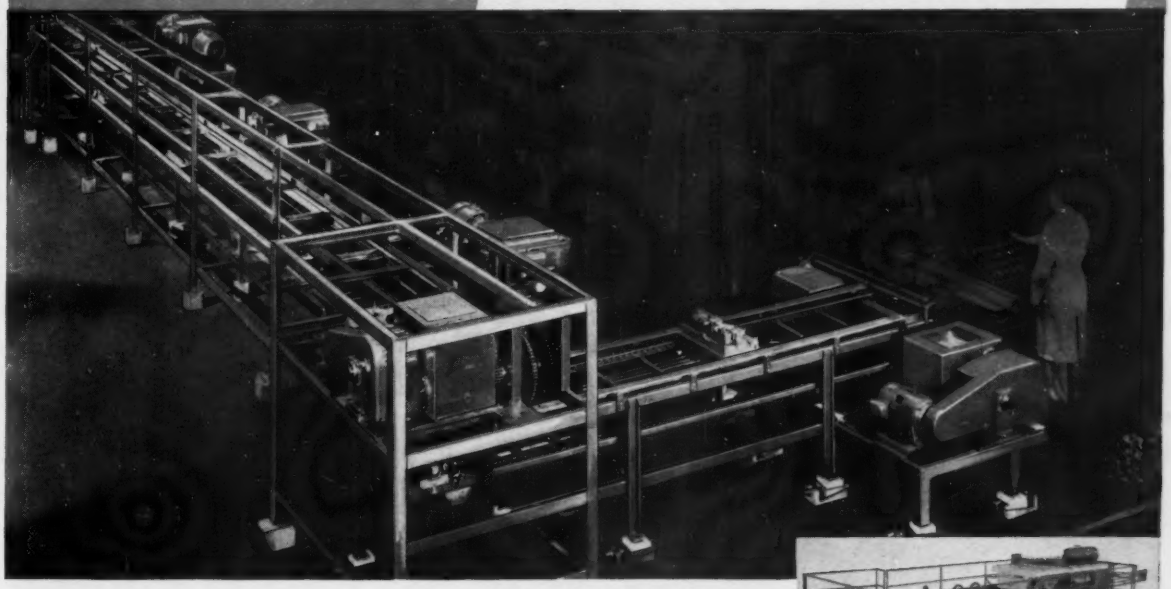


FOR GREATER AIRCRAFT PRODUCTION!

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

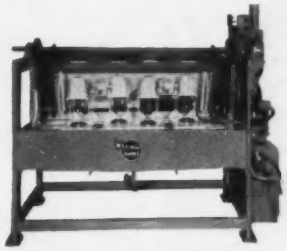
Now Available

A Special AUTOMATION EQUIPMENT Designing and Building Service



▲ Many progress-thru type machine tools employ special conveyors to return the work-holding fixtures to the loading end of the machine, as shown above. Barnes conveyors are designed to do this work automatically, in cycle with the machine, to greatly reduce work-handling costs.

▲ Another Barnes unit designed to speed work-handling is this special two-carriage automatic loader and unloader for handling heavy railroad axles before and after machining. Smooth, accurate traversing of the carriages is accomplished with a special electrical slow-down circuit.



▲ This special semi-automatic testing machine was developed by Barnes to test for leaks in automotive power steering castings. It handles four workpieces per cycle. Except for loading and unloading, all operations are performed automatically.

COMPLETE facilities are now provided by the Process Equipment Division of the W. F. & John Barnes Company for the designing and building of standard and special automation equipment. Widely experienced in this specialized field, Barnes have developed many units, both large and small, which are now successfully and profitably cutting work-handling costs and increasing production output in hundreds of industrial plants. The three units illustrated are typical of the broad range and variety of thousands of methods and processes developed by the Barnes' Process Equipment Division.

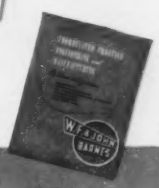
Here at Barnes, you'll find the varied engineering and creative skills, plus over 75 years of machine building background, to help you solve many troublesome production problems. And because all planning, engineering, and manufacturing efforts are closely coordinated, you have available a complete *Automation Equipment Service* from one convenient source.

ASK FOR AN ANALYSIS OF YOUR WORK-HANDLING METHODS

Find out how these unique creative and specialized resources can help you cut costs. Your problem will be given expert and individual attention.

GET THIS *Free* BOOKLET

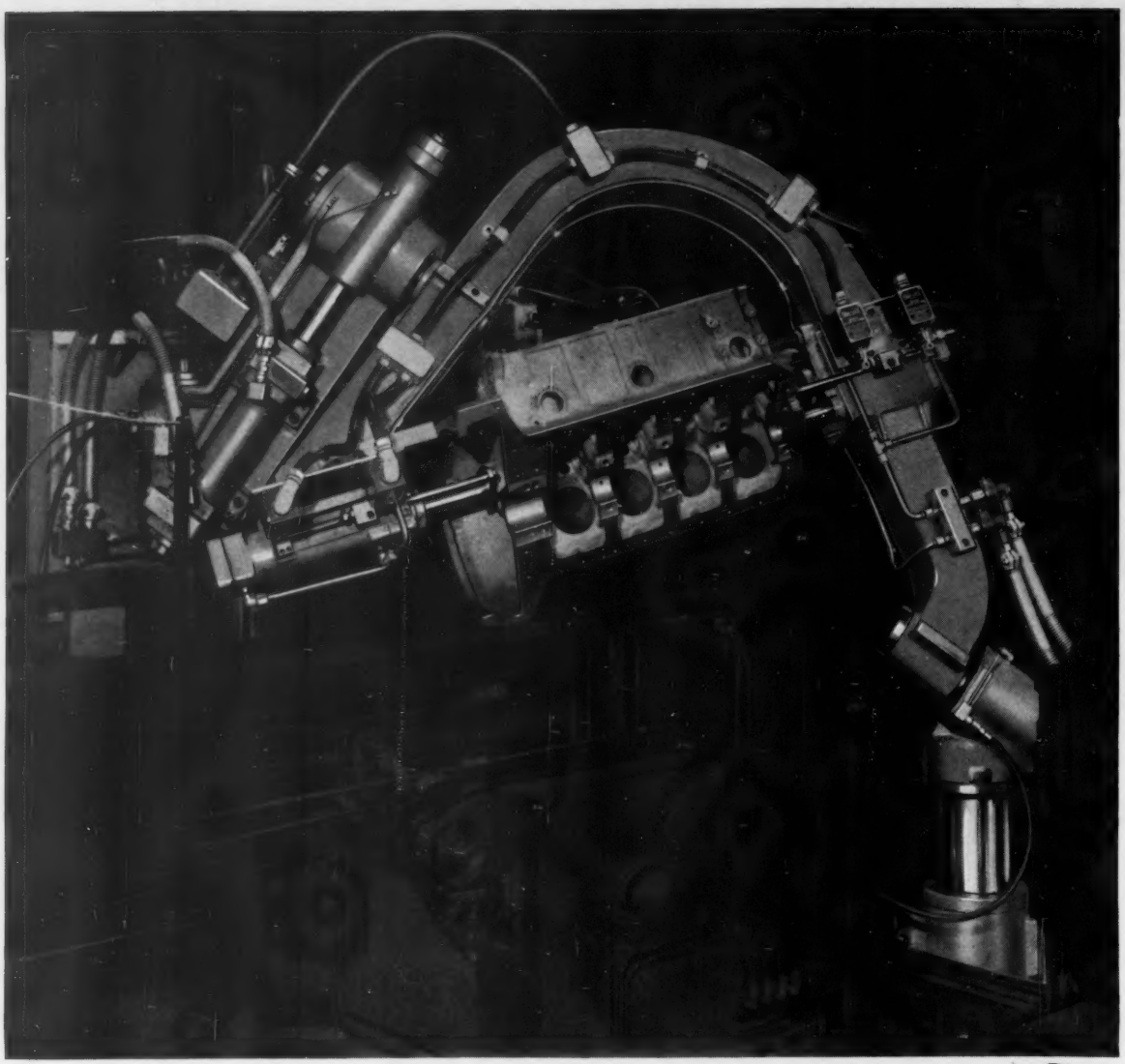
Write today for your copy of "Coordinated Creative Engineering and Manufacturing" — a 32-page booklet crammed with cost-cutting *Automation Equipment* ideas.



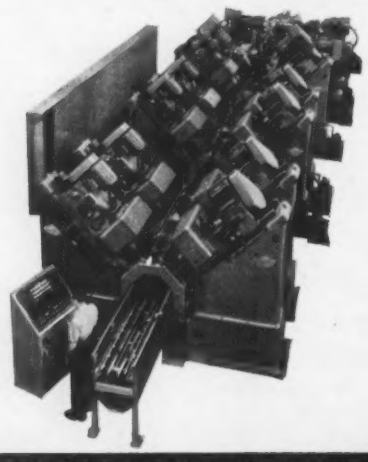
W. F. & JOHN BARNES COMPANY
PROCESS EQUIPMENT DIVISION
416 SOUTH WATER STREET • ROCKFORD, ILLINOIS

BUILDERS OF BETTER MACHINES AND EQUIPMENT SINCE 1872

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



Getting at a block from all six sides . . .



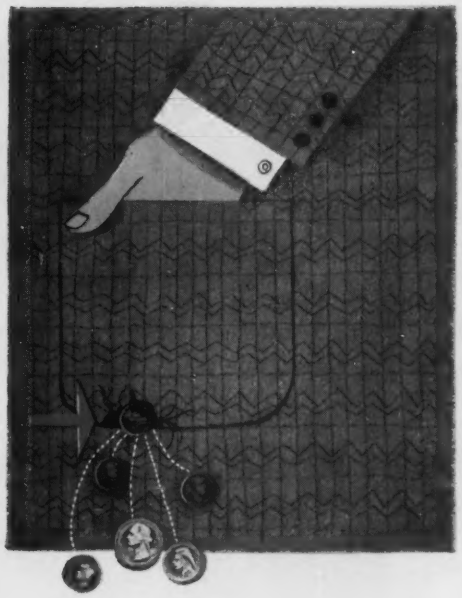
Operations on a cylinder block require getting at it from all sides, which in this case means a double 90° turnover at one point in the transfer sequence. Though this called for an unusual "gimmick", Greenlee engineers easily came up with the successful solution — the angularly-pivoted lifting and turning yoke shown above. Yet this is only *one* of the numerous Greenlee features that are making money today for the owner of this Greenlee Special. Thirty-six years of itemized experience can perhaps be of help to you, too . . .

GREENLEE BROS. & CO.
1861 MASON AVE., ROCKFORD, ILL.

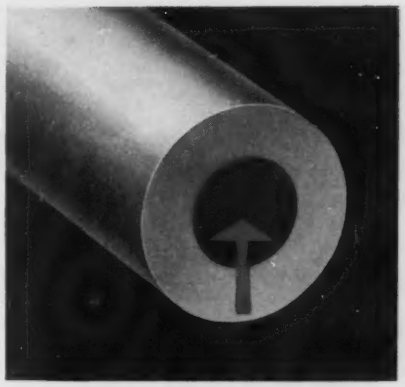
PRODUCTION MACHINERY
GREENLEE

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER MACHINES

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



a hole here costs money...



a hole here saves money

Crucible Hollow Tool Steel Bars put savings into the pockets of the metalworking industry. There's no need for costly drilling, boring, cutting-off or rough-facing operations. For the hole is already in the steel you buy. You save production time, machine capacity—avoid scrap losses.

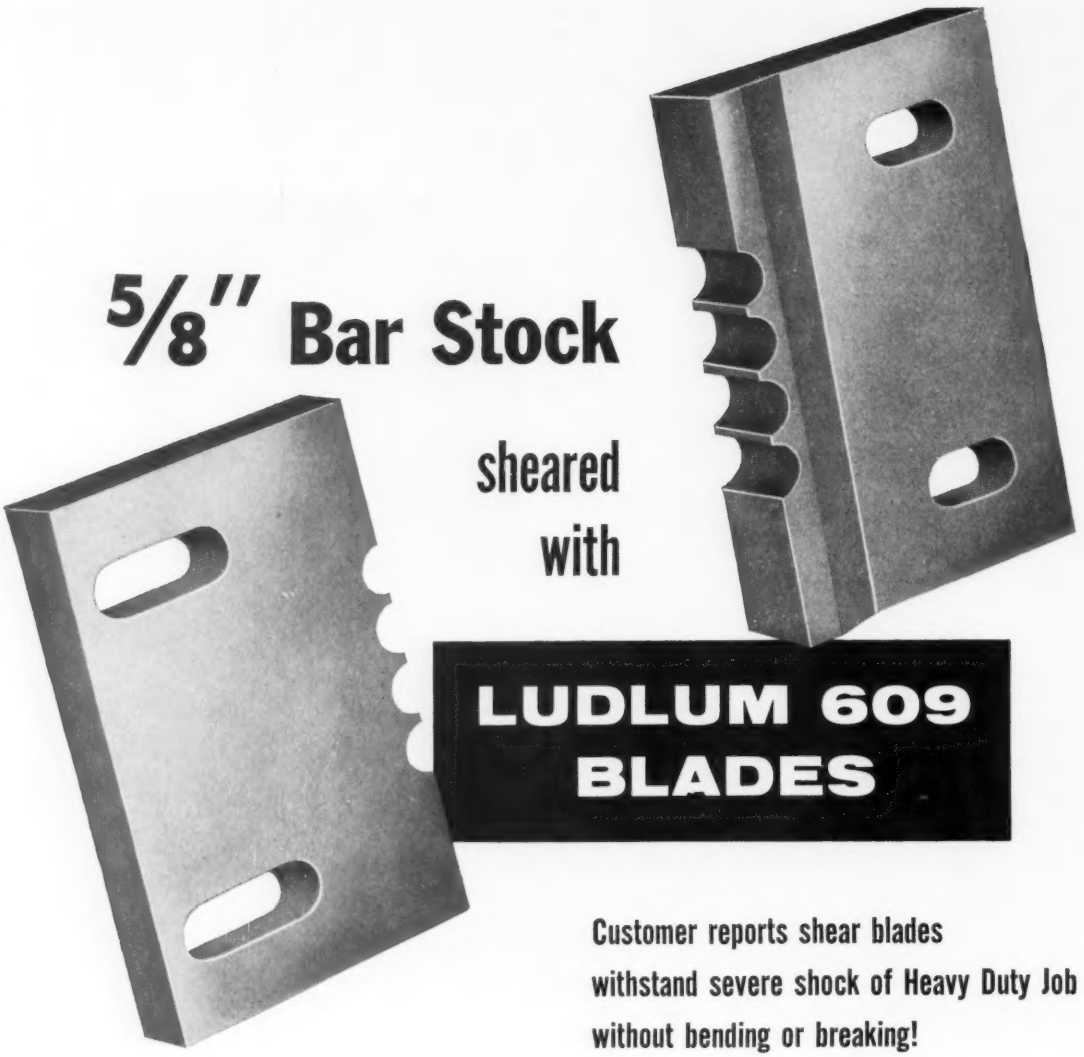
Crucible Hollow Tool Steel Bars are now available in any of our famous tool steel grades . . . in almost any combination of O.D. and I.D. sizes. And you get *immediate* delivery of five popular grades — KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air-hardening, and NU DIE V hot-work tool steels.

Your Crucible representative can show you how to save time and money with Crucible Hollow Tool Steel Bars. *Crucible Steel Company of America, Oliver Building, Pittsburgh 30, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

5/8" Bar Stock sheared with LUDLUM 609 BLADES



Customer reports shear blades withstand severe shock of Heavy Duty Job without bending or breaking!

A Birmingham manufacturer finds that Ludlum 609 blades take the tough job of shearing 5/8 bar stock in stride. A high elastic limit and fair ductility at comparatively high degrees of hardness give these silico-manganese steel blades the ability to withstand heavy shock without bending or breaking.

Besides superior shock resistance, Ludlum 609 has the advantages of excellent hardenability in larger sections combined with a fine grain size. Characteristics like these make A-L's Ludlum 609 particularly suitable for tools that must withstand severe service. Such applications include shear blades, pneumatic tools, heavy duty punches, shanks for carbide tools, and machine parts exposed to severe shocks.

For the finest in tool steels and technical assistance to help solve your tool or die steel problems, call your A-L representative or distributor today . . . or write *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa.*

Write for copy of

CUTTING TOOL MATERIALS

This 36-page illustrated booklet analyzes and compares types and covers grade selection for all major classes of cutting tools, etc., invaluable data for production men. *Ask for your copy today.*

Address Dept. M-61

For complete **MODERN** Tooling, call

Allegheny Ludlum

W&D 5352

AL® FINE TOOL STEELS SINCE 1854

For more information on products advertised, use Inquiry Card, page 255

intricately machined MAX-EL alloy steel part shows minimum distortion after heat treatment...

Halliburton Oil Well Cementing Company, Duncan, Oklahoma, selected hot rolled MAX-EL 3½ bar stock for the valve shown. It's an important part of their 5⅞" tester, used to sample fluids or gases during drilling operations, sometimes 15,000 to 20,000 feet below the surface.

The valve is machined in the annealed condition and then heat-treated. Even though it varies considerably in thickness, no distortion problems are encountered in this MAX-EL part.

Try MAX-EL in your shop. You'll like its better machinability, freedom from distortion and over-all quality. And you'll get longer tool life . . . more pieces per grind. Call Crucible for immediate warehouse delivery of MAX-EL steels.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **ALLOY STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

Are you looking for better methods for stripping paint?

What's the best way to strip metal parts in large volume?
See page 9

Do certain finishes resist your present stripping methods? Do rejects pile up and cause a bottleneck in your production line? Do you have trouble stripping vertical surfaces of large products?

Oakite's FREE booklet on "How to STRIP PAINT" will help you find more efficient procedures. You'll want to read more about:

- What's the best way to strip paint from metal parts too large to be soaked in tanks? *See page 3.*
- What's the best way to strip large areas of structural metal where a steam supply is available? *See page 5.* Where steam is not available? *See page 7.*
- What are the best ways to prepare stripped metal for repainting? *See page 11.*
- What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-based paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas? *See page 12.*

Oakite has more than a dozen fine stripping materials including:

1. Alkaline strippers that remove many types of paint and are also excellent for "killing" the overspray in water-wash paint booths.
2. Solvent strippers that work well on the newer types of synthetic lacquers.
3. A viscous solvent stripper of special value because it adheres to vertical and inverted surfaces like the sides of tanks, shelves of cabinets, etc.
4. An acidic material that strips certain organic finishes and simultaneously removes oil and rust.

FREE
for your copy of "How to STRIP PAINT" just write or mail the coupon.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE

OAKITE PRODUCTS, INC., 26 Rector St., New York 6, N. Y.

Send me a FREE copy of your booklet ***"How to STRIP PAINT."***

Name .....

Company .....

Address .....

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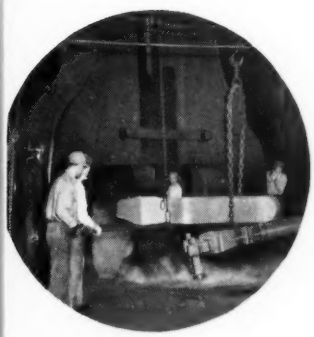
How Men and Controls Protect Industry's Confidence in *Carpenter* High Speed Steels

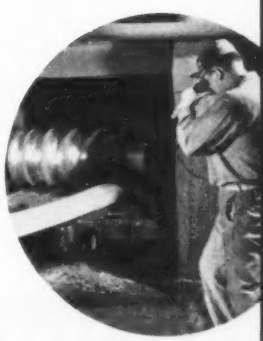
The *performance* you get from high speed steels is directly related to *how* they are produced. As a specialty mill where quality overshadows tonnage . . . and all operations are set to this standard . . . Carpenter devotes the time and attention required to produce high speed steels of the finest quality.

From careful scrap purchasing to guaranteed analysis, and painstaking time and temperature checks during melting . . . through rigid controls of bar reduction in rolling, and many other quality tests at all steps . . . these are the "indispensables" that have enabled Carpenter to produce the finest High Speed Steels for 60 years. And most important is the *personal attention* Carpenter men give to every order. The experience, pride and skill these craftsmen put into the production of every bar make Carpenter High Speed Steels your most dependable investment. Your best proof is to place your next order with Carpenter . . . and see what a difference there *can* be in High Speed Steels. THE CARPENTER STEEL COMPANY, 105 W. Bern St., Reading, Penna.

Every Order of *Carpenter* High Speed Steels Undergoes These and Many Other Quality Controls

- All scrap must be of purest quality, guaranteed analyses.
- Small, electric furnace melting units are used to control quality and uniformity to the highest degree.
- Every heat of steel is constantly checked for chemistry, temperature and melting time.
- Preheat and high heat furnaces are guarded for accurate time and temperature to prepare the steel for rolling.
- Percentage of reduction in cogging billets for rolling or forging of bars is skillfully controlled to assure freedom from internal stresses.
- Discs cut from each bar are acid etched, examined, hardened and fractured to certify internal cleanness, soundness, freedom from excessive segregation. And the hot acid etch is backed by Ultrasonic Testing.
- Slugs are cut from each lot of billets and machined in "step-down" fashion to guard against internal seams, shadow lines, etc.
- Extensive laboratory tests are made for proper hardness, micro-structure, grain size.
- Turning tests are run regularly to check cutting efficiency.
- *For best results, put your confidence in . . .*





Carpenter STEEL high speed steels

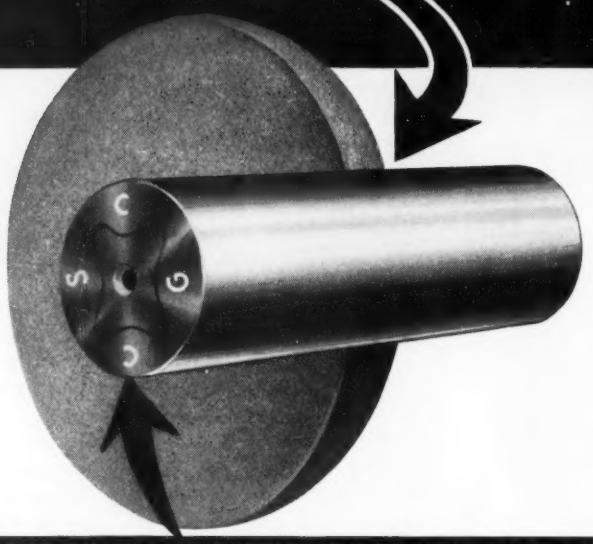
An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,

smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

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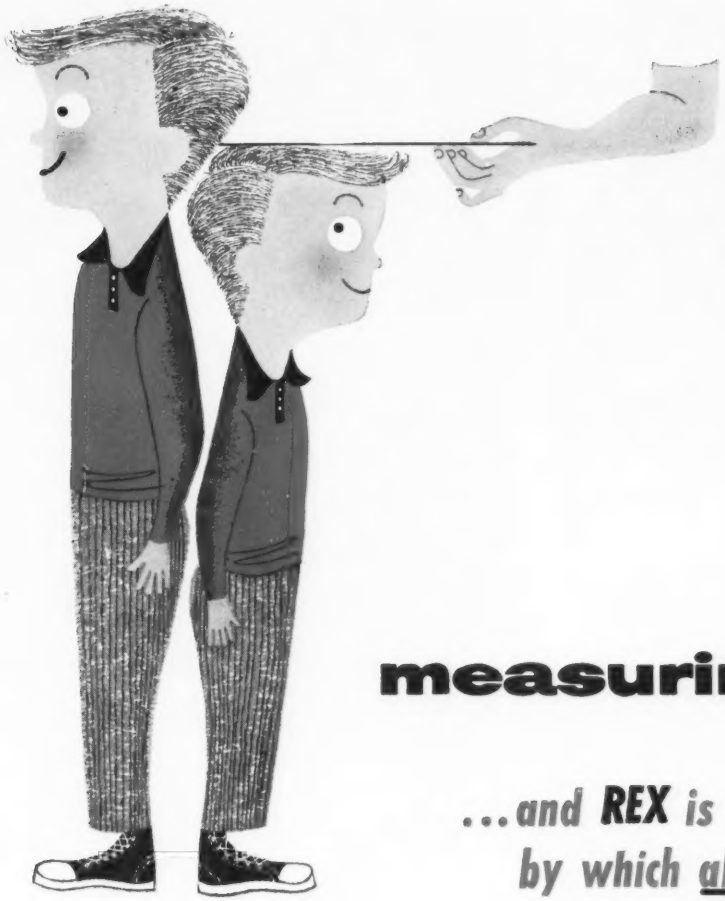


measuring up

...and REX is the standard by which all high speed steels are compared

An older brother sometimes makes a handy yardstick for measuring junior's growth. And when it comes to tool steels, REX® High Speed Steel is — and has been for over 50 years — the standard of comparison.

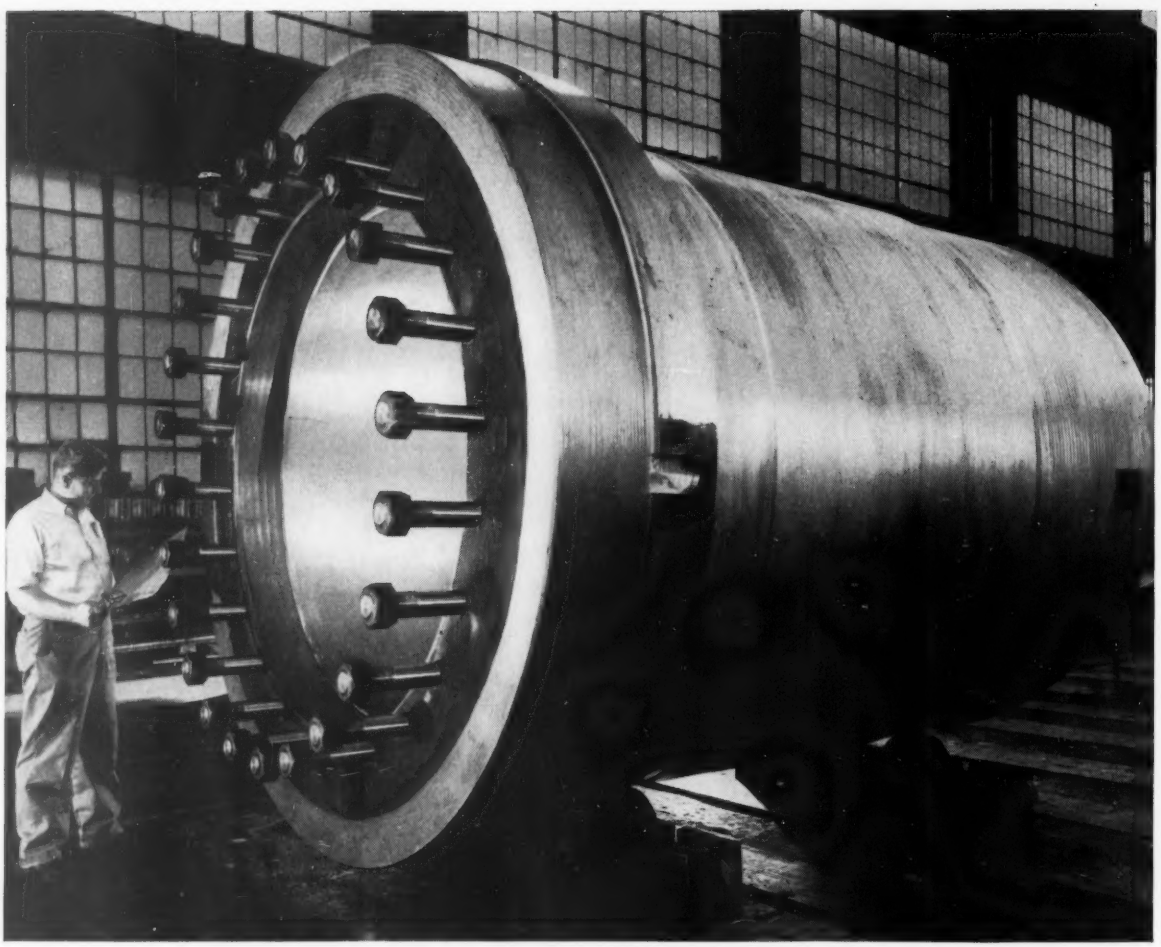
There's no mystery to REX High Speed Steel. Its quality has been time-tested in thousands of shops. And after all, it's performance — not claims — that really counts. Make your *own* comparison test. Put REX High Speed Steel to work. Compare its structure, finish, hardenability, carbide distribution and general uniformity. You won't find another high speed steel that surpasses REX.

Remember, too, that even though it is widely distributed and used, REX High Speed Steel is made *only* by Crucible. So for tops in high speed steel performance, be sure you order the Crucible REX brand.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.



76 Tons of Steel Cylinder

This big forging, shaped a good deal like an oversized kettledrum, is actually a steel cylinder for a 14,000-ton extrusion press. While by no means the heaviest forging Bethlehem has made, it is a very sturdy specimen. Also, it happens to have the largest diameter of any forged cylinder we have ever produced.

As shipped, the forging weighed just under 76 tons. It had an overall length of 14 ft, 1 in. and a maximum flange diameter of almost 9 ft. The bore at the large end of this cylinder was approximately 71 in.

This was an interesting job, the more so because it required some expert machining. That point about machining deserves special mention, for Bethlehem is equipped to machine any forging to customer specifications. Naturally, an order can be shipped as-forged if desired, but most customers rely on us for much of the machining work.

Your own plans may require forgings larger than the one shown here, or a great deal smaller. In either case, we'll welcome a call from you. Bethlehem makes forgings of every size and type, and it might surprise you to know how big—and how *little*—some of them run. Check with our people the next time you're in the market for forgings of any size.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM FORGINGS

BETHLEHEM STEEL

New Power Saw with New High-Speed Steel Band Tool

It's a new DoALL . . . mighty Power Saw designed to cut faster than any saw of comparable price! Fully automatic . . . continuous-cutting . . . employs Demon *high-speed steel* band tools and it removes only half the stock wasted by hack saws. You'll want a demonstration —

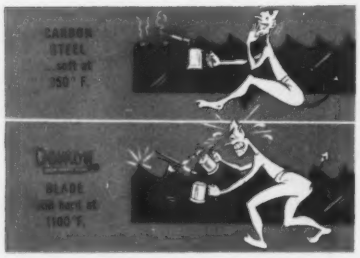
DoALL

The DoALL Company
Des Plaines, Ill., U.S.A.

Turn the page for details.

CUT CUT-OFF TIME

with this Amazing New Bandsawing Team



RED HEAT HARDNESS! Ability to take high temperature permits heavier feeds, high speeds.

LOWEST COST PER CUT! 300 pieces, 5" dia. CR steel cut with one Demon blade at a rate of 2 min. per cut.

LONGER BLADE LIFE! Ordinary blade lasted 10 cuts in hardened steel (42C), DEMON lasted 98.

LESS STOCK LOSS! Compare 1/16" Demon band kerf with 1/8" hack saw or 1/4" cold saw . . . less material reduced to chips.

DoALL Power Saw
and
HIGH-SPEED STEEL
Saw Band
Fully automatic feeding, indexing and sawing. Saw band tension and feed pressure automatically maintained for constant optimum results. Red heat hardness band tool. Capacity up to 12" rounds, 12" x 12" flats. Also fixed speed models without automatic indexing.

Faster Cutting Plus Longer Tool Life
Plus Less Stock Waste Means Lower Cost Per Cut

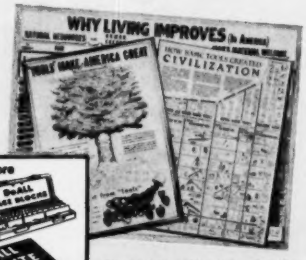
THE DoALL Power Saw is specifically designed to employ the new Demon *high-speed steel band tool.* This heat resistant tool can be run at higher speeds under heavier feed pressure than carbon steel blades. The Power Saw cuts at least twice as fast as any other type of cut-off machine of comparable power and capacity. Here are typical examples:

MATERIAL	SIZE	DoALL TIME
4340	7" dia.	7 min. 30 sec.
18-8 Stainless	3½" sq.	4 min.
1020	6" dia.	2.87 min.
Ketos	11¾" dia.	16 min.
1020	3½" dia.	1.3 min.
4150	9" dia.	10 min.

LESS STOCK WASTE. Compared with circular cutters, reciprocating hack saw blades or other parting tools, the DoALL saw band removes much less material. It produces a kerf only 1/16" wide. Savings in chip waste can be phenomenal.

EXAMPLE. A DoALL Power Saw used to cut high chrome—high carbon slitter blanks saved one complete ½" piece every 8 cuts as compared with hack sawing. Each half-inch piece thus saved represented $30 worth of this costly material. And, the DoALL averaged 28 minutes per cut compared to 47 minutes for the hack saw.

FREE DEMONSTRATION. ***You can see it and believe it! Call your local DoALL Store or write DoALL, Des Plaines, for a free demonstration. And, ask for new Catalog.***

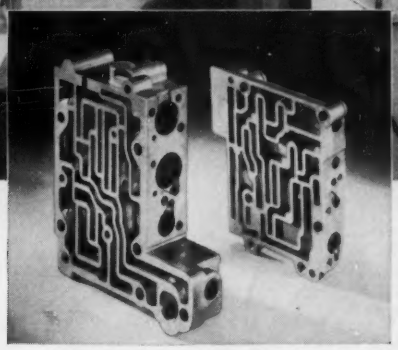


EDUCATIONAL STUDY WALL CHARTS
Economic Principles
$1.00 each Post Paid
Lower quantity prices.

Call Your DoALL Service-Store
DoALL SAW BANDS
DoALL CASE MACHINE
DoALL GRANITE PLATES
Machine Tools • Cutting Tools • Measuring Instruments
Shop Supplies • In Stock
The DoALL Company, Des Plaines, Ill.

Friendly DoALL Stores . . . (in 40 cities)

Personalized Service . . . Complete Stocks . . . Local Delivery



Holes on extremely close centers vary in diameter from 1/16" to 13/16". The valve body has 33; the cover, 18.

"—BUT OUR PRODUCTION RUN IS LIMITED."

"SO WAS THE RUN ON THIS AUTOMATIC TRANSMISSION PART, BUT". . . .

HERE'S HOW ZAGAR TOOLING SAVED MONEY HAND OVER FIST

This aluminum die casting is processed in its entirety by Zagar planning, except for milling two faces. Two lines of Zagar standardized self-clamping drill jigs ream, tap and drill both valve body and cover. With 24 heads and 24 fixtures, Zagar performs work on 51 holes on close centers. Step tools take care of reaming and burnishing. The fixtures were designed to compensate for slight inaccuracies in the die casting. Thus has Zagar engineering solved an acute problem of limited production without the purchase of costly special machines.

Ask on your letterhead for Bulletin "M-1."

ZAGAR TOOL, INC.

24000 LAKELAND BOULEVARD • CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

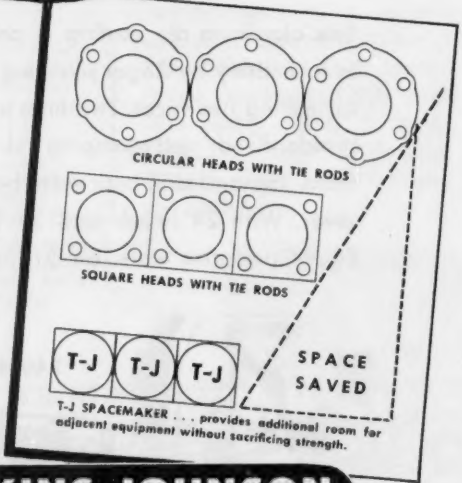
Rx for . . . AUTOMATION

OFF SHELF DELIVERY!

T-J Spacemaker CYLINDERS

- ★ OIL pressure to 750—AIR to 200 P.S.I.
- ★ New Compact Design . . . Saves up to 40% Space
- ★ Proven Performance . . . with Extra High Safety Factor
- ★ Super Cushion Flexible Seals for Air . . . New Self-Aligning Adjustable Oil Cushion
- ★ Hard Chrome Plated Bodies and Piston Rods

Compare feature by feature—you'll see why T-J Spacemaker Cylinders are today's top choice for streamlined power movement in automation! The only cylinder with all the extras as standard. Write for bulletin SM-454-2. The Tomkins-Johnson Co., Jackson, Mich.


CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
T-J
T-J
T-J
SPACE SAVED
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

T-J **TOMKINS-JOHNSON**
RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

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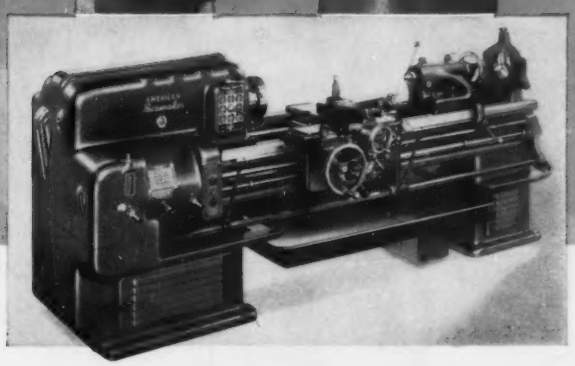
"a wonderful job..."



Mr. Ray Hogan of McGee & Hogan Machine Works, Salt Lake City, Utah says "Your machines are doing a wonderful job for us."

This company uses "AMERICAN" Lathes and Radial Drills. It is known throughout the inter-mountain territory as a leader in metal working contracting, enjoying a reputation for low cost and quality second to none.

The accompanying illustration shows one of their 20-inch heavy duty "AMERICAN" Pacemaker Lathes chasing a large screw for a customer who has suffered a breakdown on one of his machines. The factor of time, cost and quality are paramount on a job of this kind. Mr. Hogan says his "AMERICAN" met this challenge one hundred percent.

Whether your work is production, maintenance or tool room, the power, ruggedness, range and stabilized accuracy of "AMERICAN" Pacemaker Lathes meet each and every requirement.

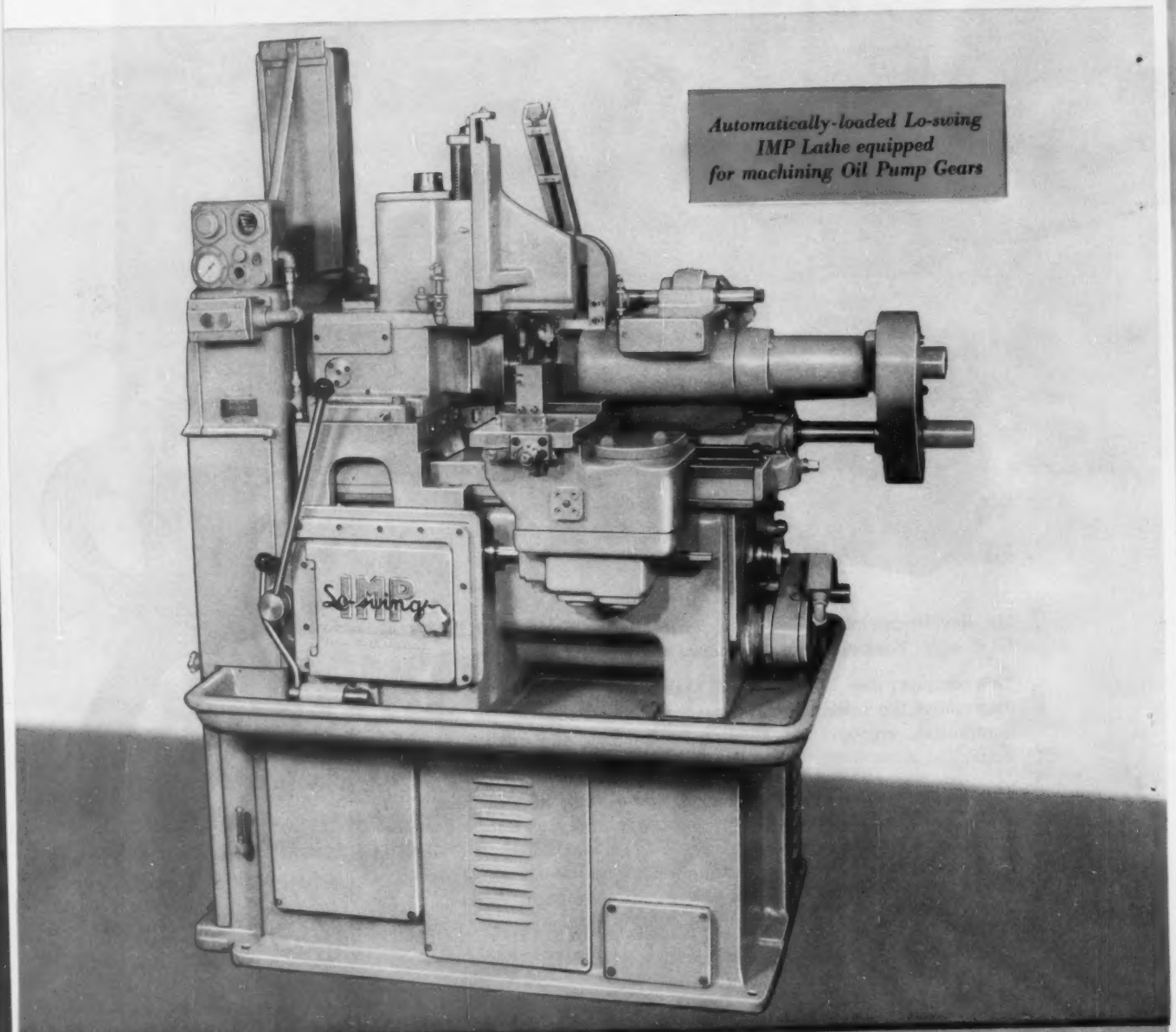
Send for bulletin No. 16 and get the facts.

THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

Lathes and Radial Drills

MACHINE OF

AUTOMATICALLY LOADED *Lo-swing* IMP LATHE SPEEDS PRODUCTION OF OIL PUMP GEARS



Automatically-loaded Lo-swing IMP Lathe equipped for machining Oil Pump Gears

PRODUCTION COSTS

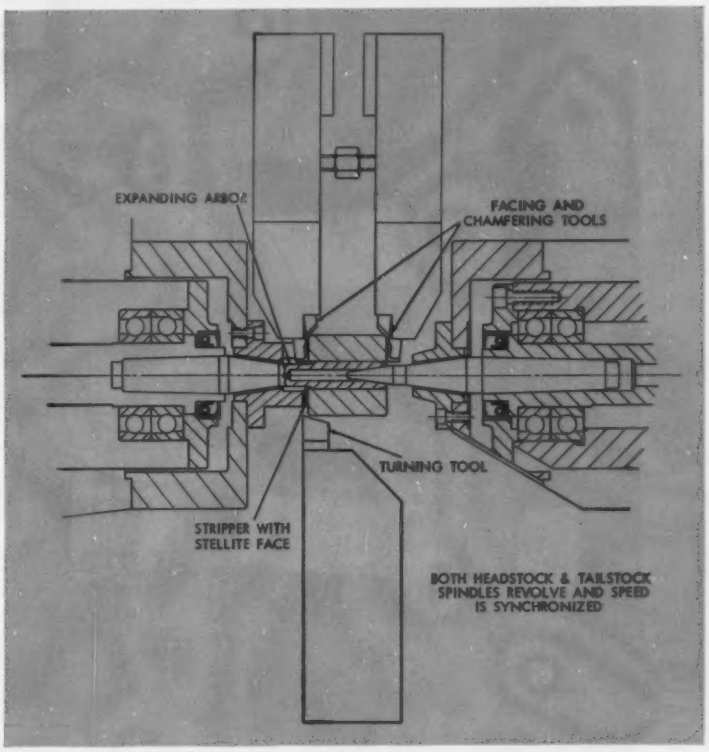
THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK

PROBLEM: To automatically load, turn, face and chamfer pump gears made from powdered iron.

SOLUTION: The Lo-swing IMP Automatic Lathes selected for this job were equipped with a Rotary Type Loader which assures a constant flow of pump gears through the machine on a complete automatic cycle.

The parts arrive at the machine with the bore finished to size and with a small amount of surplus material to be removed from the faces and outside diameter.


EXPANDING ARBOR
FACING AND CHAMFERING TOOLS
TURNING TOOL
STRIPPER WITH STELLITE FACE
BOTH HEADSTOCK & TAILSTOCK SPINDLES REVOLVE AND SPEED IS SYNCHRONIZED

The Lathes are equipped with revolving head and tailstock spindles, both of which are driven from a splined jackshaft. The advantage of the double end drive is two-fold. Since the piece is driven from both ends, coarser feeds may be used, and the double-end drive assures synchronization of the speed of both spindles eliminating slippage wear on the collet expander. Details of the tooling used are shown in the line drawing.

The pump gears are loaded into the chute, visible in the illustration, and are fed by gravity to the openings in the Rotary Loader which indexes the parts to the proper position. They are then picked up automatically by the revolving spindles which are withdrawn during the indexing of the Rotary Loader.

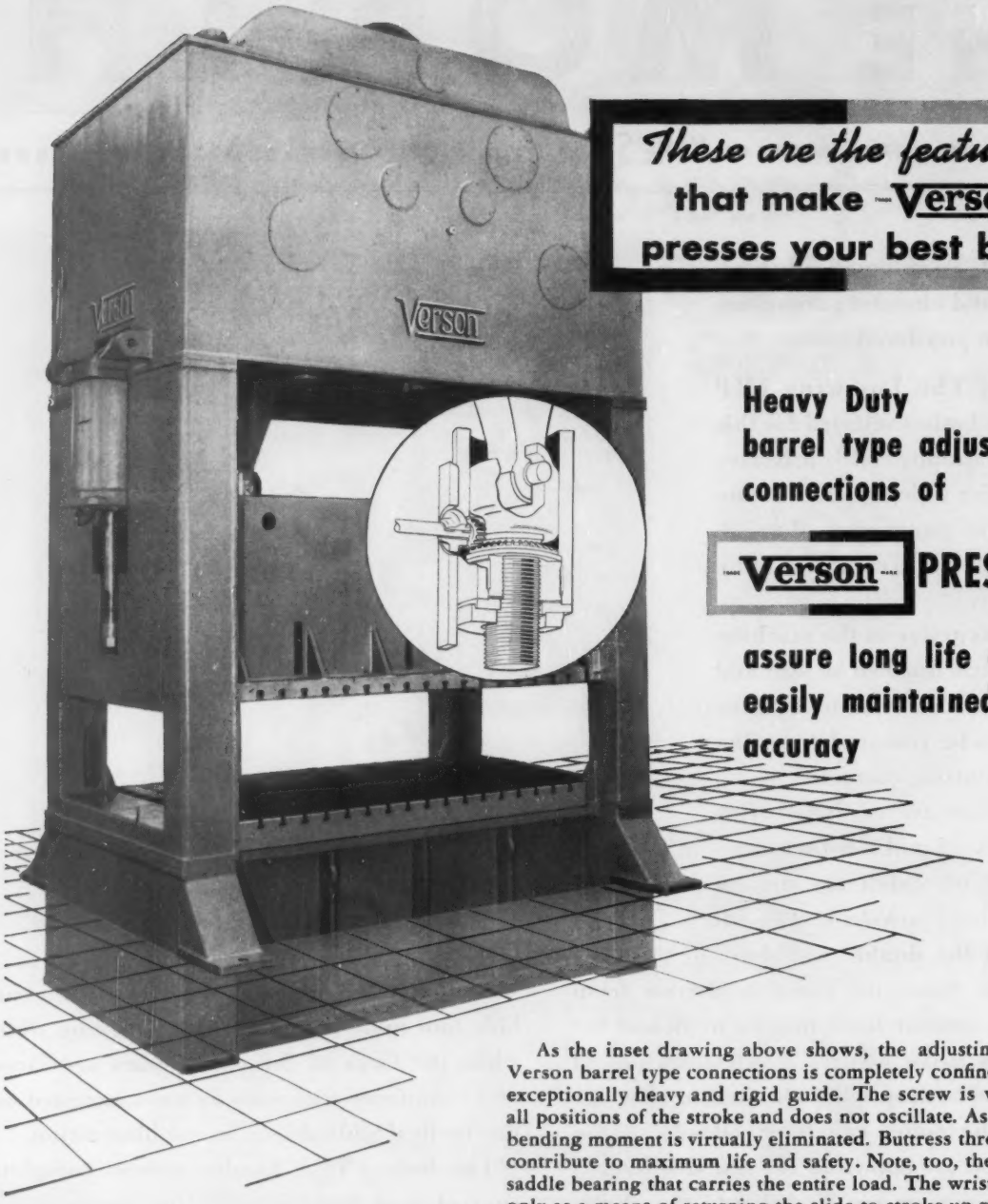
The outside diameter is turned with a carbide tool mounted on the front turning slide, while the faces of the pump gears are faced and chamfered with carbide tools mounted on the vertical slide shown in the illustration.

The Rotary Type Loader assures complete control over the fast revolving pump gears, eliminating danger to personnel and damage to parts since they are completely stationary by the time they reach the discharge chute.

Engineered jobs are our specialty. Our staff is at your disposal to assist in solving your problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

ARE LOWER WITH *Lo-swing*



These are the features that make —Verson— presses your best buy

Heavy Duty barrel type adjustable connections of

—Verson— PRESSES

assure long life and easily maintained accuracy

As the inset drawing above shows, the adjusting screw of Verson barrel type connections is completely confined by an exceptionally heavy and rigid guide. The screw is vertical at all positions of the stroke and does not oscillate. As a result, bending moment is virtually eliminated. Buttress threads further contribute to maximum life and safety. Note, too, the heavy saddle bearing that carries the entire load. The wrist pin serves only as a means of returning the slide to stroke up position.

Adjustment can be manual or motorized. In either event, the extra long adjusting screw provides exceptionally liberal adjustment.

This is another example of the kind of engineering that has won for Verson presses their reputation for quality. For you, it all adds up to better stampings at lower cost. Whether you require a single press or an entire stamping plant complete with tooling, we'll be pleased to make recommendations.

Catalog G-53 presents basic data on the entire Verson line. Write for your copy, today. It may be the first step towards the more efficient production of stampings.

Verson Press for every job from 60 tons up.

—Verson—

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

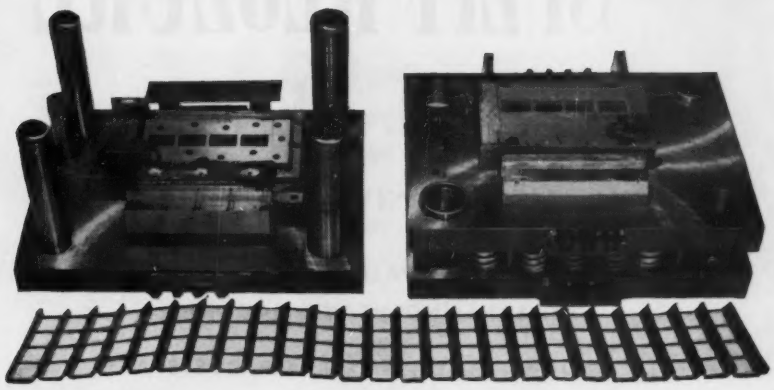
MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

For more information on products advertised, use Inquiry Card, page 255

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation



Maker of Agricultural Machinery Gets Good Results With Lehigh H

The Gleaner Harvester Corp., Independence, Mo., has every reason to be proud of its revolutionary, self-propelled combine. For this mechanical marvel, with its centerline design, is a joy to behold as it takes large, continuous bites into blowing fields of grain.

Making parts for this practically human thresher and separator calls for some highly specialized dies made from outstanding tool steels. For example, the progressive die shown here, made of Bethlehem Lehigh H tool steel, produces the combine's straw rack (foreground). Operating in a 150-ton press, the die blanks and forms 22-gage galvanized sheet steel, about 50 strokes of the press being required to make each rack. The die is subjected to more than 20,000 strokes before inspection is required — ample proof of its durability.

Lehigh H is our high-carbon, high-chromium air-hardening tool-and-die steel. It's outstanding for long production runs because of its wear-resistance and toughness. Moreover, it offers minimum distortion during heat-treatment, plus the ability to harden deeply.

Lehigh H is safe-hardening. It is cooled in still air from a hardening temperature of 1850 F, and minimizes the cracking hazards of intricate dies, thin sections, and insufficient radii.

Your tool-steel distributor will be pleased to answer your questions about Lehigh H. He's always at your service.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Carburization of Tools Can Be Detrimental

Widely known are the beneficial effects obtained by intentionally carburizing some tools during heat-treatment. In general, wear-resistance of the surface is increased, while at the same time the shock-resistance of the core is maintained. But what is frequently overlooked is that carburized cases added unintentionally can be detrimental to service life.

Laboratory study of failed tools has shown this type of trouble often happens. For example: Rivet sets, failing from brittleness after short service, were found to have a carburized case; coining dies failed by splitting, due to a deep carburized case (0.030 in.); an extrusion punch shattered, due to an excessive carburized case (0.040 in.), containing 3.34 pct carbon.

Unintentional carburized cases commonly result from heat-treatment operations where there is improper control of atmosphere, such as "inert" packing material, "neutral" atmosphere in furnace, and "neutral" salt bath. All of these, of course, are actually carburizing.

The cure for this type of trouble is simple — don't put on a carburized case. Or if you do, be sure to grind it off later. On most tools the required dimensions will not permit grinding off an excessive case. So the practical solution is proper control of the heat-treatment.

High-Speed Tool Steel Cuts 35 Teeth in Bronze Worm Gear

This tangential cutter, fitted with an insert of Bethlehem 66 High-Speed Tool Steel, is shown cutting a tooth on a bronze worm gear. The gear is 74 in. in diameter and is 3-1/16 in. deep. It has 35 teeth, having a circular pitch of 6.25 in. With its excellent red-hardness, balanced abrasion and shock-resistance, Bethlehem 66 High-Speed is an ideal steel for difficult cutting jobs.

Why users prefer GARLOCK

SPLIT-KLOZURE

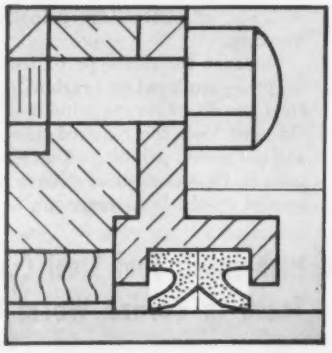
OIL SEALS

For Heavy Equipment

1. EASY TO INSTALL ON THE SHAFT WITHOUT DISMANTLING HEAVY MACHINERY

2. DOWN-TIME AND REPAIR COSTS ARE REDUCED TO A MINIMUM

The 45,000 ton tanker, "World Glory," built at Bethlehem Steel's Quincy yard, is the largest ever built in the Western Hemisphere. The rudder stock bearings, upper and lower pintle, are protected by Split-KLOZURE Oil Seals.



Cross section shows the dual opposed Split-KLOZURE assembly on the rudder post of the "World Glory." This dependable, easy-to-install seal keeps vital lubricants *inside* the rudder trunk's voids, keeps seawater *out*.

*KLOZURE is a registered trademark for Garlock oil and grease seals.

The construction of the Garlock Split-KLOZURE* permits easy and quick application in inaccessible locations. Instead of applying over the end of the shaft or journal—as is necessary with solid, one-piece seals—the Split-KLOZURE is placed *around* the shaft or journal. This can be done at any convenient place near the bore or housing into which the seal is to be applied.

Thus, the installation of a Split-KLOZURE is accomplished with *minimum* down-time, and *without* dismantling machines *or* removing heavy shafts, bearings, gears, couplings or other machine parts. Split-KLOZURES are ideally suited for use on machines operated in localities remote from repair or service facilities.

*For complete details on Garlock Split-*KLOZURES*, write today for bulletin AD-124.*

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Sales Offices and Warehouses: Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, Los Angeles, New Orleans, New York City, Palmyra (N.Y.), Philadelphia, Pittsburgh, Portland (Ore.), Salt Lake City, San Francisco, St. Louis, Seattle, Spokane, Tulsa.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

GARLOCK

For more information on products advertised, use Inquiry Card, page 255

Whatever kind of gears you make...
Whatever way you make them

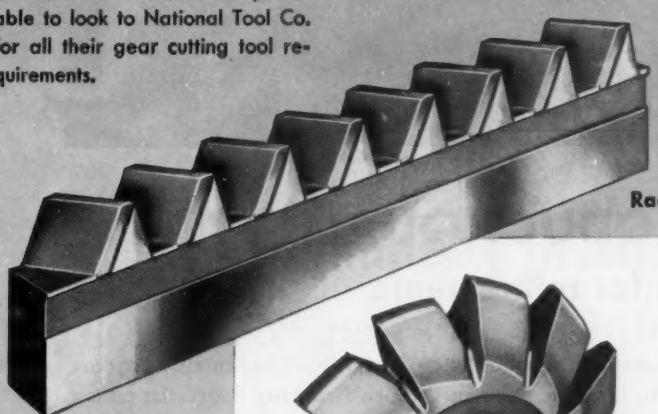
National Tool Co.

can supply the right type cutting tool
because we make *all* types

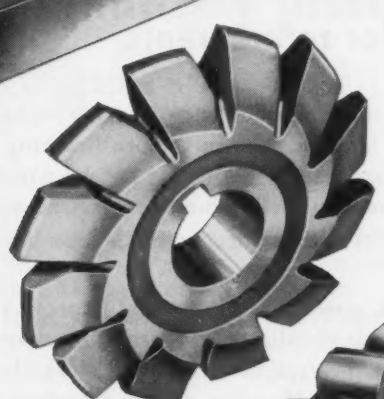
National Tool Co., with 50 years experience in the manufacture of special cutting tools, makes *all* varieties of gear cutting tools for *all* types of spur, helical and worm gears—as well as for sprockets and splines. Whatever your gear requirements—large or small—National engineers can help you decide the most efficient method of producing them. Many gear manufacturers have found it profitable to look to National Tool Co. for all their gear cutting tool requirements.

Gear Shaving Cutters

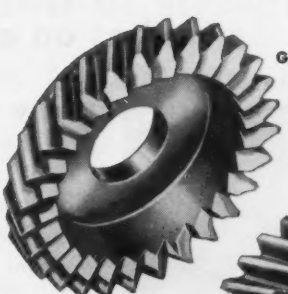
Hobs



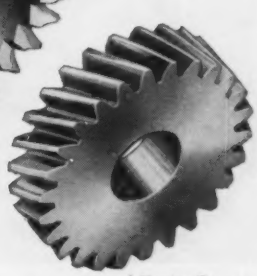
Rack Type Gear Shaper Cutters



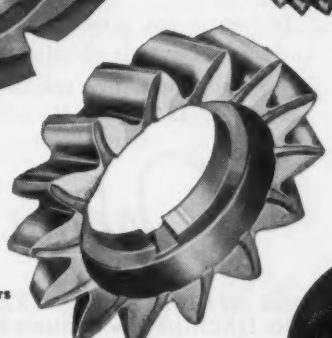
Involute Gear Cutters



Gear Shaper Cutters



Master Gears



Herringbone Gear Cutters

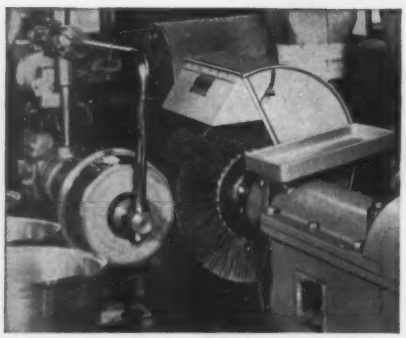
National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

Representatives in major industrial centers

WANT BETTER PRODUCT QUALITY?

He has an eye for refinements



SAVES 33%. *Here, Osborn Power Brushing polishes stainless steel utensils in two steps where it formerly took three. Finishing time is cut 33%. This is typical of results obtained with an* **OBA.**

POWER brushing may be the answer to a higher-quality product for you. To find out, have an Osborn Brushing Specialist take a close look at your cleaning, finishing and burr removal operations. When making an **O**sborn **B**rushing **A**nalysis, he studies these operations and submits a written report with recommendations for improvements.

In your plant, power brushing might improve product quality—and save thousands of dollars every year, too. Ask for an **OBA**. There is no obligation. Just call or write *The Osborn Manufacturing Company, Dept. D-25, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

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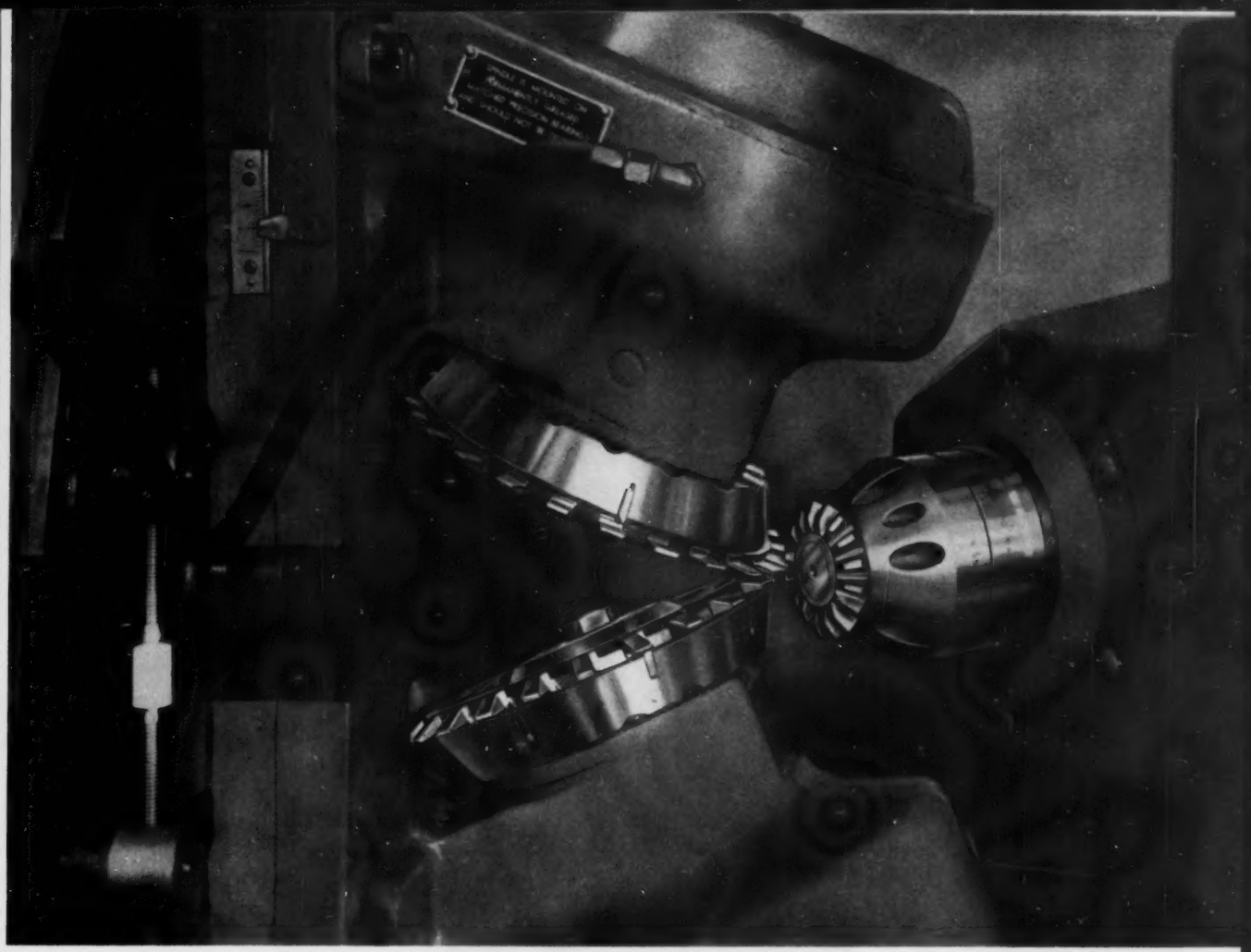


How to multiply production of straight bevel CONIFLEX® gears and pinions *by as much as 500%*

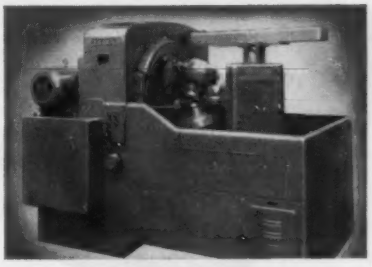
You can do it with the new No. 104 Straight Bevel CONIFLEX Generator.

The two interlocking disc-type cutters, with 24 blades each, *complete a gear in one rapid operation.*

This is the key to the remarkable performance of this new Gleason machine which achieves production rates up to 5 times as fast as any previous generator. In addition, a new generating method insures high efficiency, excellent finish, and maximum cutter life.

The range of capacity, and the ease of setup, make the No. 104 Straight Bevel CONIFLEX Generator ideal for jobbing.

Calculations have been reduced to a minimum and can be done long hand or with slide rule.



The No. 104 Straight Bevel CONIFLEX Generator completes gears up to 8½" diameter and 1⅜" face width, and from 20 to 3 DP.

We will be glad to send a bulletin giving further details on request.

® Straight bevel gears with localized tooth bearing.

GLEASON WORKS

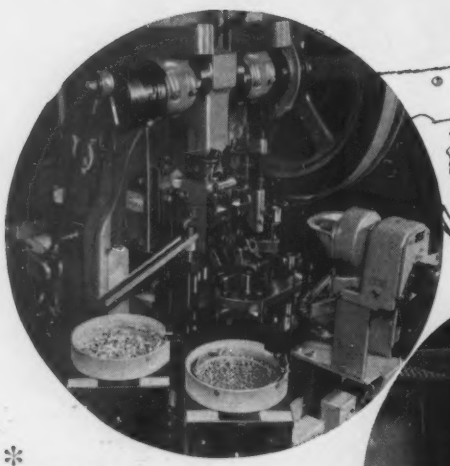
Builders of bevel gear machinery for over 85 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

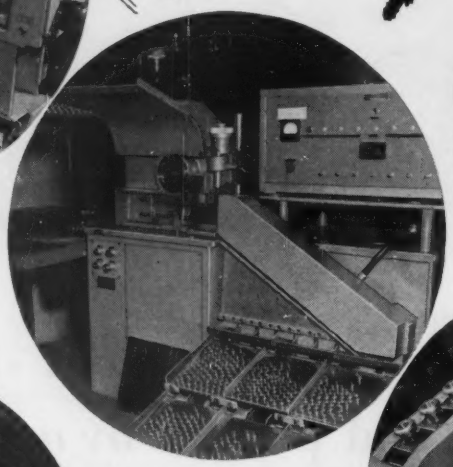
Blueprints call for bearings?

Call on NEW DEPARTURE

PDQ*!

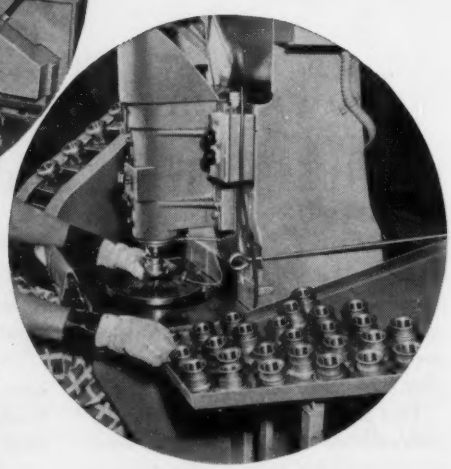


* **PRICE!**—Savings of automation in New Departure plants are reflected in prices impossible with less modern methods. Here a unique machine automatically assembles refrigerator door bearings . . . with notable savings for the buyer.



* **DELIVERY!**—Electronics work at New Departure! Bearing races are speedily sorted into six dimensional classifications by this machine. Volume is up because New Departure invested in this modern equipment.

* **QUALITY!**—Painstaking quality control, at every manufacturing step, works to approach perfection in every bearing. Here you see an electronic inspection of operational noise level. Any sub-standard part is automatically rejected. There's no chance for error. You are sure of top quality—every time!



PLUS ENGINEERING SERVICE—There's no substitute for experience . . . and New Departure offers you an unmatched backlog of accumulated ball bearing knowledge. So whenever the prints call for ball bearings, check with New Departure for engineering assistance in bearing selection and application. Phone, wire or write . . . you'll get action from New Departure—PDQ!

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT

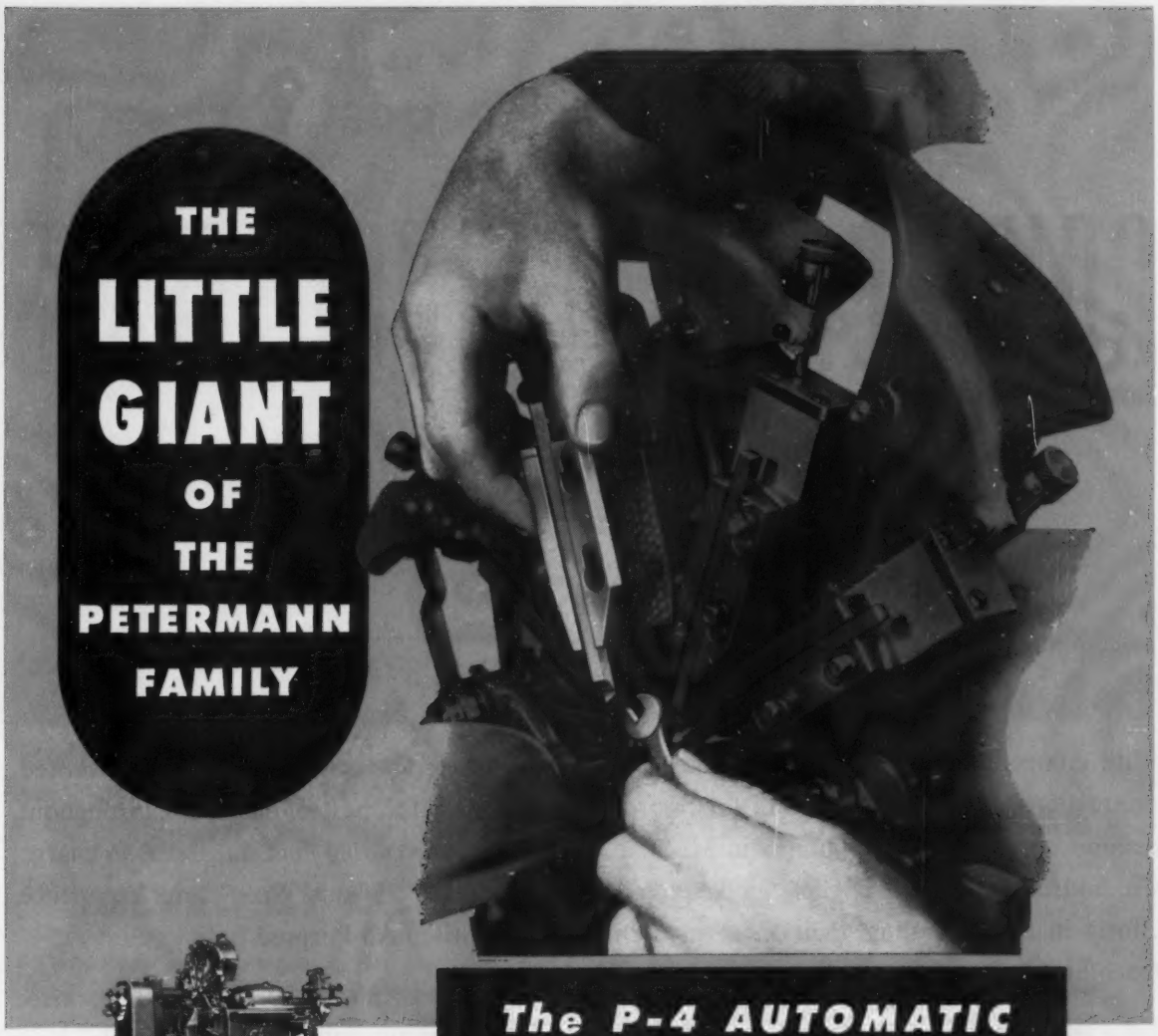
NEW DEPARTURE

BALL BEARINGS

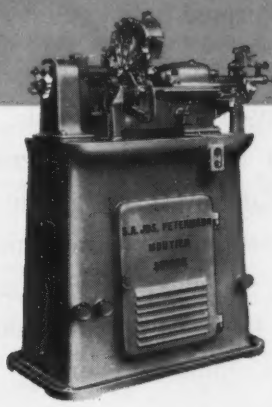
NOTHING ROLLS LIKE A BALL

For more information on products advertised, use Inquiry Card, page 255

THE LITTLE GIANT OF THE PETERMANN FAMILY



The P-4 AUTOMATIC



For work within its capacity (pieces 5/32" in diameter and 1½" long) we offer a machine of deadly accuracy and high production . . . 10 speeds to 12,000 RPM.

On this page we can show only *one* of the P-4's salient advantages . . . the ability to remove a tool for sharpening without removing it from the tool holder . . . *and grinding in place.*

The many other advantages are described in Catalog sent on request.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

Nothing but the best for

CONE-CARBIDE TOOL TESTS

Houghton Antisep All-Purpose Base selected for the test of carbide tools on Conomatics

With competition demanding ever increasing production speeds and lower and lower production costs, the Cone Automatic Machine Co. and carbide tool suppliers pooled their efforts in demonstrating their most modern machining equipment.

In these tests, as in all machining operations, three factors determine the results—the speed and power of the machine, the cutting and edge-holding ability of the tools and the cooling and lubricating qualities of the coolant.

Advances in machine design and carbide tool development were clearly demonstrated, using only the best of materials throughout, *including the cutting fluid.* Engineers in charge, who know coolants from long experience, used Antisep All-Purpose Base.

Houghton Antisep All-Purpose Base, mixed one part to twenty-five parts of water, gives high lubricity and anti-welding performance, discourages bacterial growth and rancidity and provides the high cooling efficiency and low cost of water. Try it today on *your* toughest machining jobs. E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.

ANTISEP All-Purpose Base

. . . a product of

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

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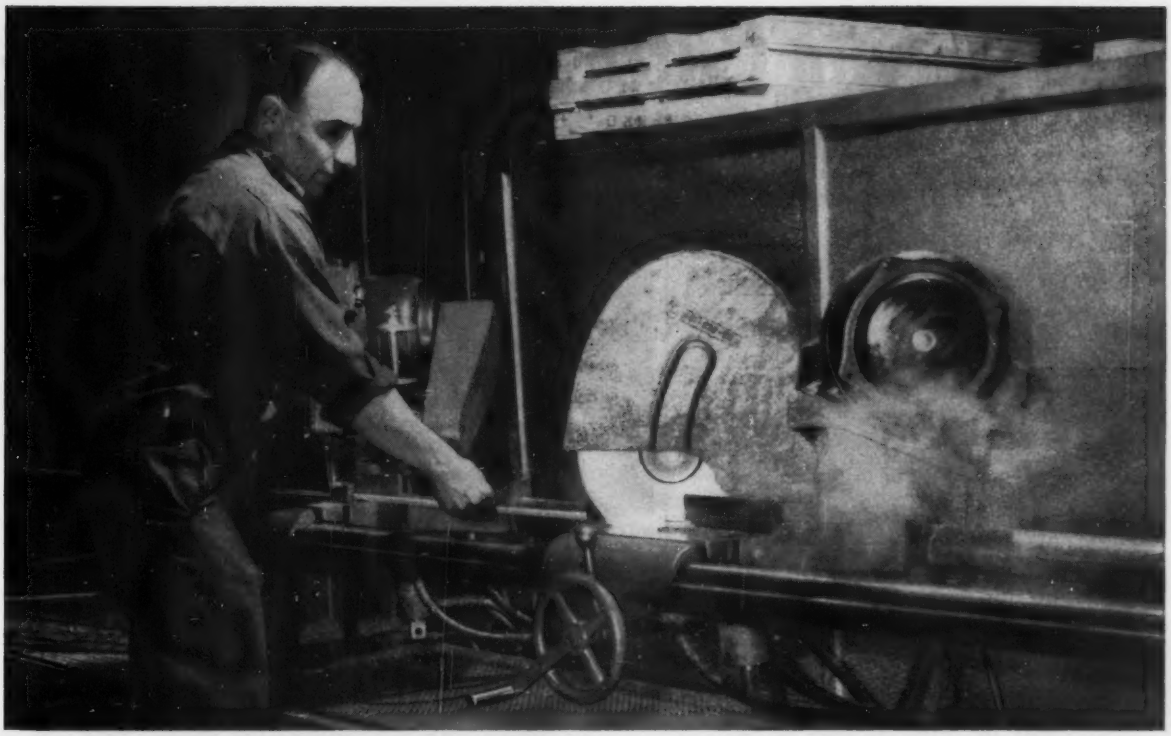


Aluminum Air Seal Mfg. Co. Reports:

"OUR PROBLEM WITH GRAVITY OILERS WAS SOLVED BY CITIES SERVICE CUTTING OIL!"

When flow of oil from gravity oilers was restricted by gum formation and residue, Aluminum Air Seal Mfg. Co. switched to Cities Service Chillo #22 Cutting Oil. Results: Plenty of oil flow, increased saw life, cleaner finish cuts!

Here's the report as Cities Service received it from D. C. Cover, Plant Supt. of Aluminum Air Seal Mfg. Co.:

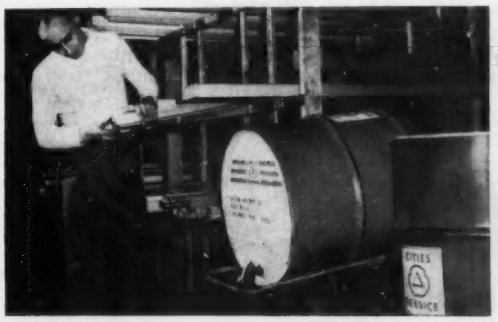
"For the past three years we have been using your Chillo #22 with excellent results.

"Prior to that time, we experienced considerable trouble because our gravity oilers were not functioning properly due to residue and gum formation which restricted the flow of cutting oil to the saw. Consequently, this inadequate supply of cutting oil permitted excessive wear which, of course, greatly reduced our saw life.

"At this time, a Cities Service Lubrication Engineer called on us and recommended Chillo #22 as a solution to this problem. Not only was the problem of adequate supply eliminated but we found the oil gave excellent saw life as well as clean finish cuts.

"As you know, we supply aluminum stock to Trim-a-Seal plants throughout the country. *Whenever a new plant is set up we recommend that they use your product for cutting because we know it will do the job.*"

If you'd like to learn more about the oil "we know will do the job," contact your nearest Cities Service representative or write Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.



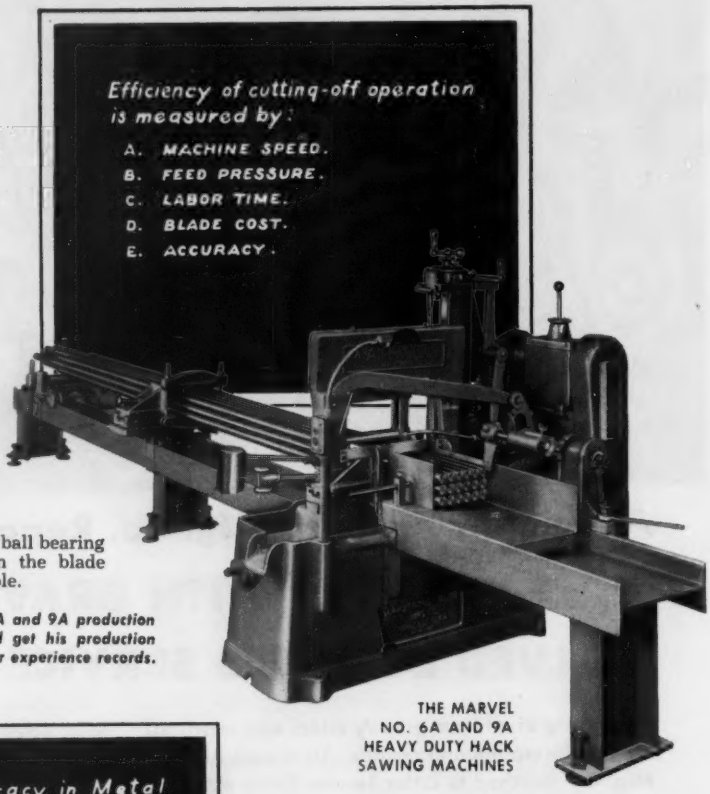
EXAMINING ALUMINUM EXTRUSION, an Aluminum Air Seal employee observes clean cut made with help of Cities Service Chillo #22 Cutting Oil. Firm supplies aluminum stock to 25 Trim-a-Seal plants throughout country.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Efficiency in Cutting-off is Important

Practically all machining operations start with pieces cut-off from bars or billets. Hence, inefficiency, or lack of capacity, in the cut-off department can hold up or stagnate the entire plant.



THE MARVEL NO. 6A AND 9A HEAVY DUTY HACK SAWING MACHINES

A. Are all-ball-bearing and provide a quick return; therefore they run FASTER than others on the same work.

B. Can apply as much as 1200 pounds feed pressure—two to ten times as much as other hack saws and band saws.

C. Are fully automatic, requiring no more operator attention than an automatic screw machine; and set-up for any bar size and cut-off length is extremely simple.

D. Use a non-breakable high speed hack saw blade — the type of saw blade that produces the greatest number of square inches of metal cut per dollar of blade cost—two to ten times (or more) as much as any band saw.

E. Because of their exceptional sturdiness, ball bearing reciprocating frame, ability to tension the blade "truly taut", their accuracy is dependable.

If you are not using modern, improved MARVEL NO. 6A and 9A production hack saws, call the local MARVEL Field Engineer and get his production and cost estimates on your work—to compare with your experience records.

Formula for Accuracy in Metal Sawing:
ACCURACY = Length, Straightness, Squareness
Straightness / Squareness = Blade Rigidity / Blade Toughness
MARVEL
HIGH-SPEED EDGE
ARMSTRONG BLUM MFG. CO.
CHICAGO ZZ MADE IN U.S.A.

The composite MARVEL High-Speed-Edge Hack Saw Blade—cuts **any** machinable material efficiently. There is no time lost changing blades for different types of steel; no time lost replacing shattered blades, because MARVEL High-Speed-Edge Hack Saw Blades are positively **unbreakable.** These superior blades have the finest high speed steel cutting edge welded to a strong alloy steel body. They will stand-up under the highest speeds and heaviest feeds attainable on any make hack saw. Can be safely tensioned tauter than any other blade—cut-off not only straight but also square and with less stock loss.

Write for catalog C-55—showing and describing eleven different series of Metal-Cutting Sawing Machines and MARVEL-High-Speed-Edge Hack Saw Blades and Hole Saws.

MARVEL Metal Cutting SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

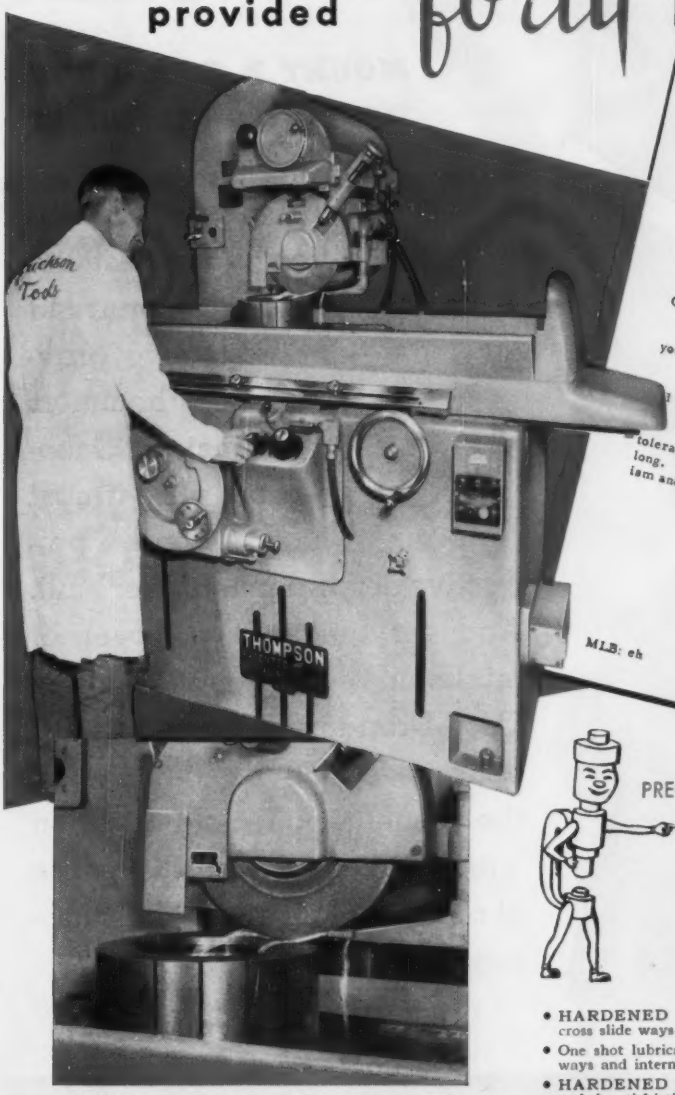
For more information on products advertised, use Inquiry Card, page 255

The Erickson Tool Company

asked for at least .0001 for parallelism and size. . .

The Thompson 2F (8x10x24) Super Precision Grinder

provided "forty millionths"



ERICKSON TOOL COMPANY
EAST 83RD AND HAMILTON AVENUE
CLEVELAND 14, OHIO

September 17, 1954

The Thompson Grinder Company
Springfield, Ohio

Attention: Mr. John Wilson,
Vice President.

Gentlemen:

May we take this opportunity to express our satisfaction with your Thompson 2F 8 x 10 x 24 Surface Grinder.

We purchased this grinder on your claim of .0001 for parallelism size. This tolerance is necessary for most of our work.

Upon its arrival we asked a service man to prove this .0001 tolerance, using 5 blocks on a surface of 4 inches wide by 20 inches long. The test blocks showed .00004 (forty millionths) for parallelism and size. This was well within your guarantee.

Yours truly,

ERICKSON TOOL COMPANY

M. L. Benjamin,
President.

MLB: eh

"Erickson products are sold and guaranteed to hold extreme accuracy. It is vital that we have the precision equipment necessary to manufacture these products. Our Thompson 2F Grinder delivers this precision. In the above picture we are grinding a #1200 expanding sleeve and hold within .0001 parallelism and size."

PRECISION PETE says:

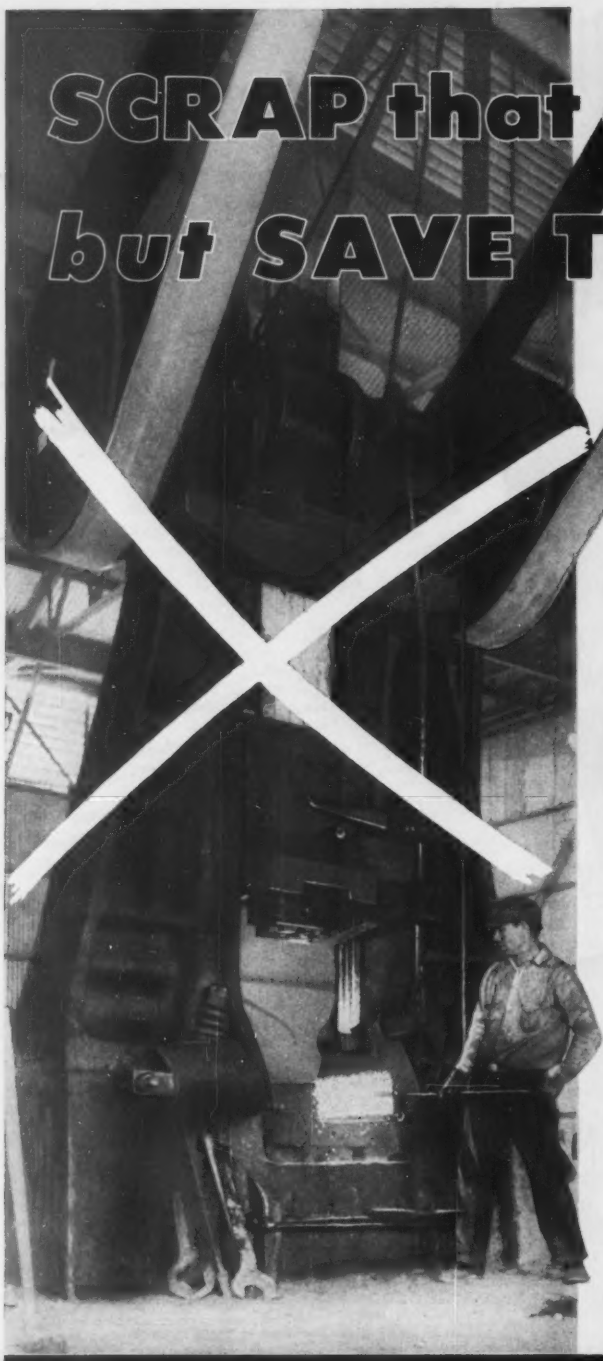
"You may be surprised to find that Thompson 2F Grinders cost less than some others and still provide all these features for greater accuracy and longer service. Fast delivery, too!"

- **HARDENED AND GROUND** cross slide ways completely sealed.
- One shot lubrication to cross slide ways and internal saddle bearings.
- **HARDENED AND GROUND** sealed anti-friction vertical slide.
- **HARDENED AND GROUND BED WAYS** with automatic lubrication.
- 3600/1800 R.P.M. 2 speed wheel head. Heavy alloy steel spindle heat treated, runs in super precision ball bearings accurately preloaded, lifetime lubricated.
- Handy control panel.
- Elevation micrometer stop graduated in .0001"
- **GROUND THREAD FEED SCREW.**
- Automatic wheel **TRUING** device.
- Longitudinal hand feed with automatic engagement.
- Hydraulic head movement throttle with rapid traverse.
- Hydraulic table movement throttle.
- Elevating hand wheel graduated in .0005".

Call, write or wire for estimate

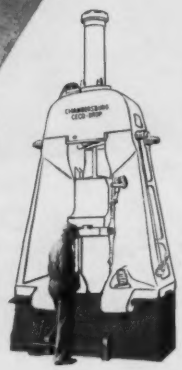
Thompson Grinders

THE THOMPSON GRINDER COMPANY • SPRINGFIELD, OHIO



SCRAP that old hammer but SAVE THE ANVIL!

MOUNT A CECO-DROP UPPER-WORKS ON IT



To meet competition, your best bet is to scrap your old unproductive gravity drop hammers and install Ceco-Drops, the most modern, most productive drop hammers ever built. And for quick changeover at minimum cost, you can have Ceco-Drop upper-works fitted to your present anvil. You have all the benefits of modernization without the time and expense of replacing the anvil or disturbing the foundation.

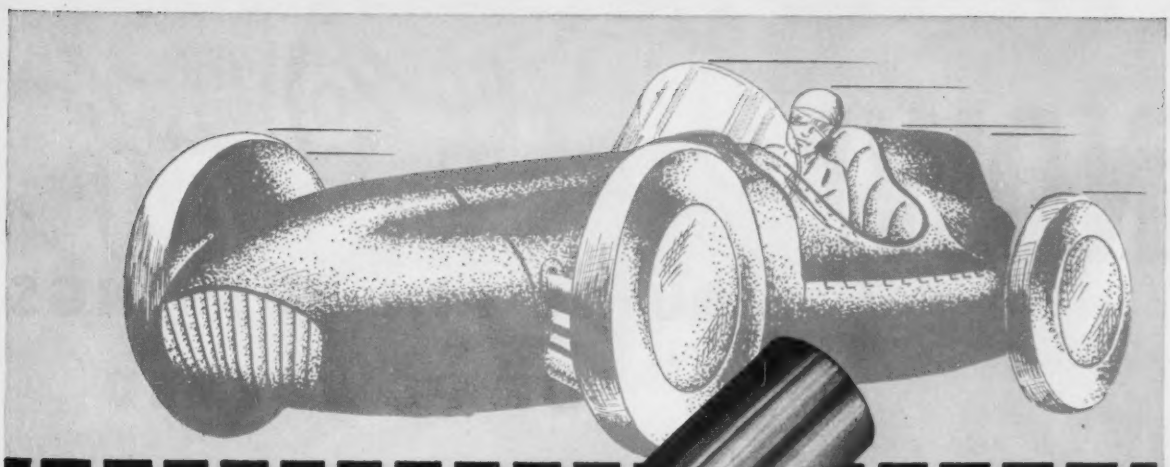
Write for Bulletin 57-L-4

CECO-DROP

Made by the BUILDERS of THE IMPACTER

CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.

For more information on products advertised, use Inquiry Card, page 255



R and L TAP AND DIE HOLDER

WHEN SECONDS COUNT

The R and L TAP AND DIE HOLDER readily changes from right to left due to the patented instant release action. It can also be adapted to work on short threads, do bottom tapping, or die up to shoulders.

Releasing or non-releasing, (also furnished for acorn dies), this tool is made in a complete range of sizes from ⅝" diameter shank to 1½" diameter shank.

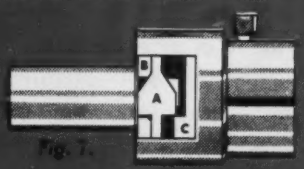


Fig. 1. Ready to start threading operation.

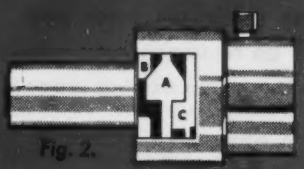


Fig. 2. Instantly engaged to full contact.

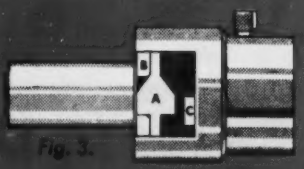


Fig. 3. Fully released. Note ample clearance between contact points of clutch.

Write for Catalog

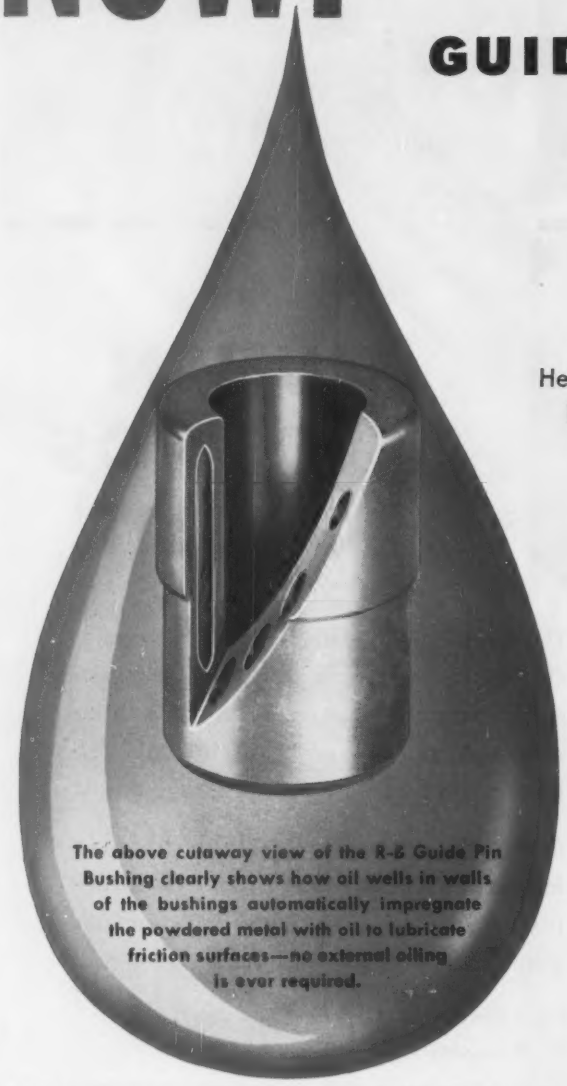
RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO AVAILABLE FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

NOW! Self-Oiling

GUIDE PIN BUSHINGS OF POWDERED ALLOY STEEL



The above cutaway view of the R-B Guide Pin Bushing clearly shows how oil wells in walls of the bushings automatically impregnate the powdered metal with oil to lubricate friction surfaces—no external oiling is ever required.

Here's an entirely new concept in guide pin bushings—made of heat treated powdered alloy steel, each bushing has filled internal oil wells. Lubrication to friction surfaces is automatic and no external oiling is required throughout the long life of the bushings.

Wear characteristics of these bushings are comparable to that obtained with finest bronze bushings. In addition, this new R-B design greatly reduces guide pin wear and the possibility of seizing or galling. Self-oiling, less guide pin wear and longer life add up to minimum maintenance, reduced costs and maximum usage of press time.

4117

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 79 • 12619 BURT RD. • DETROIT 23, MICHIGAN

Please send me additional information.

NAME _____ TITLE _____

COMPANY _____

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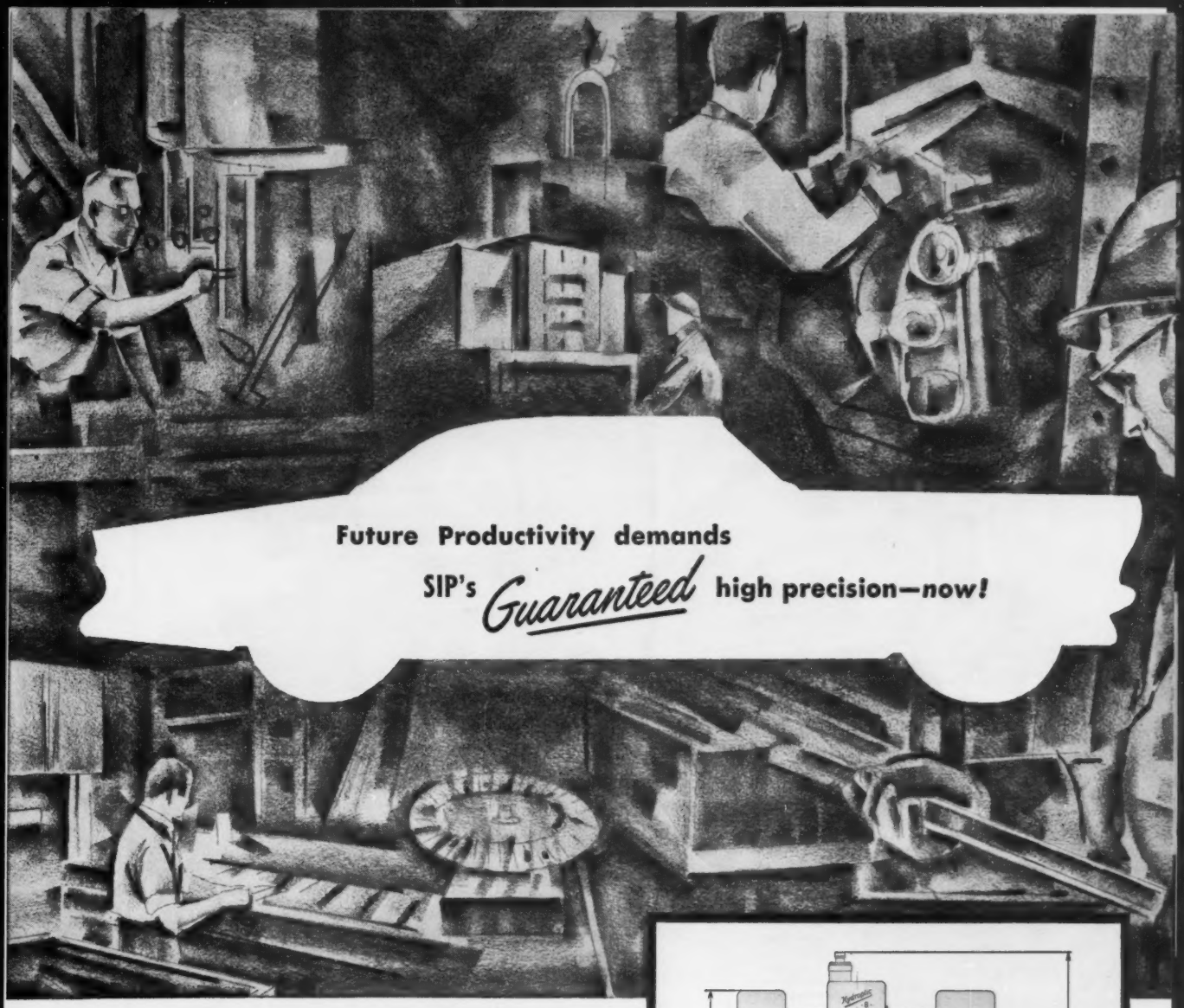
Also Produced in
OTHER ALLIED PLANTS
SPECIAL COLD FORGED PARTS
STANDARD CAP SCREWS
PRECISION GROUND PARTS
SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS

For more information on products advertised, use Inquiry Card, page 255



Future Productivity demands

SIP's *Guaranteed* high precision—*now!*

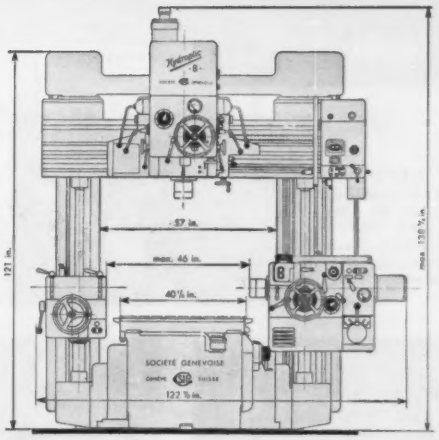
YOUR planning for the future is influenced by economists' predictions for tremendous industrial expansion during the next 15 years. By way of example, our 1970 population of 200-million is expected to support a market for 7.5-*million* new passenger cars.

To keep pace with growth, forward-looking Managements right now are formulating, if not actually developing, long-range tooling modernization programs. It is their one sure way to strengthen competitive positions…to take advantage of ever-increasing manufacturing efficiencies…to effect the necessary labor-and-dollar savings.

Basic to your present and future tooling programs are SIP Hydroptic Jig Borers. However exacting your precision standards, however intricate and voluminous your production, it is the SIP Hydroptic which will define and establish an essential *basic* Accuracy in your plant—and reliably maintain it during the busy years to come.

SIP offers you a *guaranteed* setting Accuracy: within .0002" on the large Hydroptic 8P's and 7P's, and within .00015" on the medium size Hydroptic 6. For complete details, see your nearby SIP Distributor, or write directly to

AMERICAN SIP CORPORATION
100 East 42nd Street, New York 17, New York.

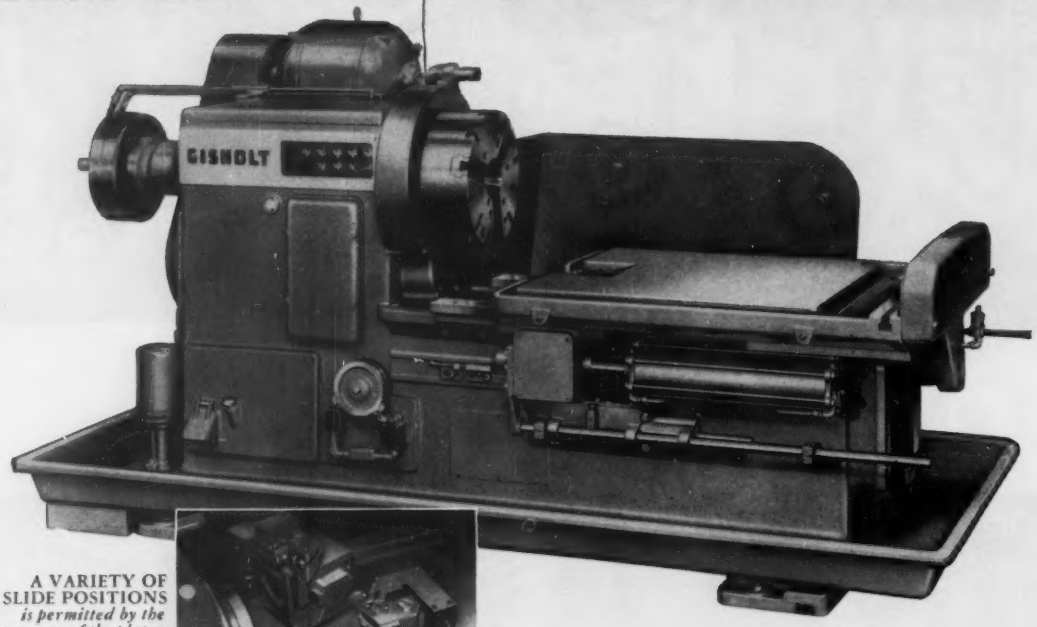


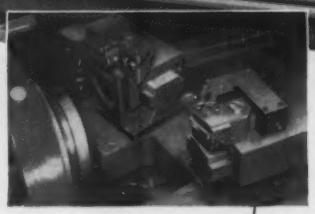
HYDROPTIC-8P JIG BORING AND MILLING MACHINE

SIP
for precision

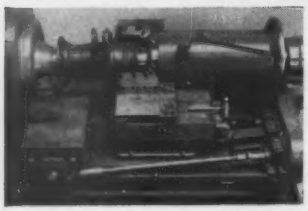
The divisions on the Hydroptic's Standard Scales are magnified 22.5x on to Viewing Screens. They give you *"a tenth at a glance,"* with nothing to wear out—ever.

What CAN'T these SIMPLIMATICS do?

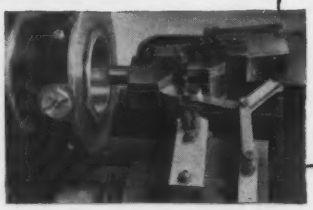




A VARIETY OF SLIDE POSITIONS *is permitted by the large area of the platen table. Angular feeds are no problem. Compound slides are unnecessary.*



TAILSTOCKS *can be mounted on platen table for between-centers work; can be operated by hand or pneumatically.*

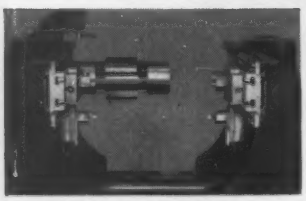


A LINKAGE ARRANGEMENT *between the slides can be used for spherical boring in conjunction with facing and turning.*

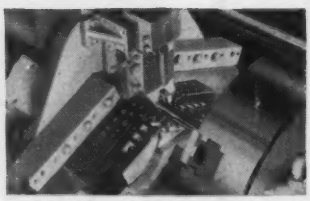
It's this simple basic design that makes the Simplimatic so readily adaptable to solve a variety of machining problems. It's a standard machine—yet it can be individualized to give you the high speed production of an automatic lathe designed solely for the job at hand. Think of the difference in cost.

The adaptations shown here are only a few of the almost unlimited possibilities of the Simplimatic. When you have a "special" job of machining parts in large volume, look into the Simplimatic before you build a special machine. The chances are good you'll save time and money.

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*



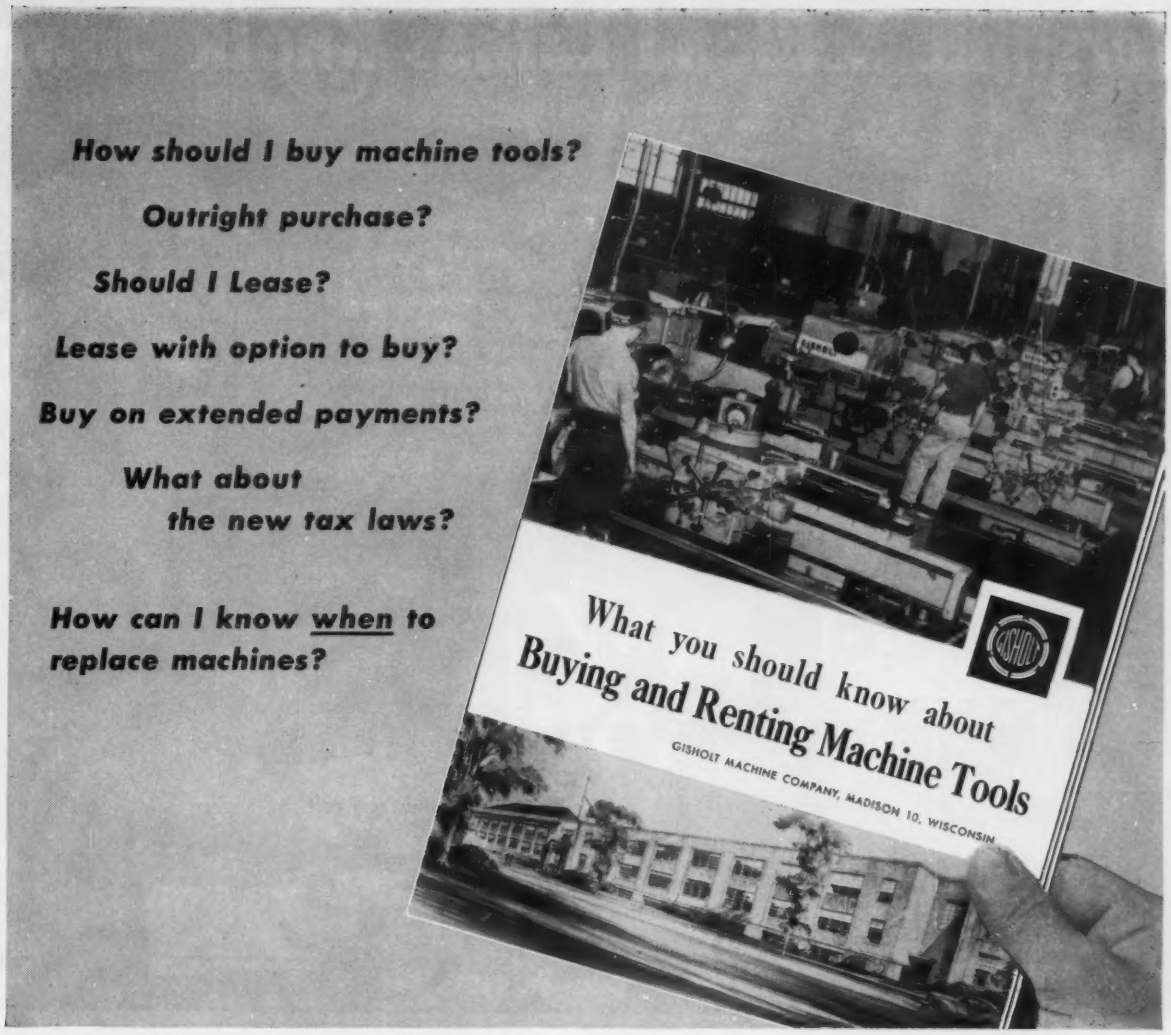
SIMULTANEOUS DOUBLE END MACHINING *is possible with full utilization of base machine.*



VERTICAL HEAD. *Tool slides can also be mounted on a vertical instead of horizontal platen. A choice of arrangements is possible.*

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES


How should I buy machine tools?
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Buying and Renting Machine Tools
GISHOLT MACHINE COMPANY, MADISON 10, WISCONSIN

This New Gisholt Bulletin Will Help You

Recently, a lot of things have been happening which tend to confuse the outlook for buyers of machine tools and other industrial equipment. So Gisholt prepared this booklet to deal with the most important of them. The aim is to help you find the wisest answers in your particular case.

The booklet discusses leasing and time payment plans, makes cost comparisons, discusses depreciation under the new tax codes, replacement programs and the MAPI formula for machine replacement. A copy of this booklet is yours for the asking. No obligation, of course. Use the coupon.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

The Gisholt Round Table represents the collective experience of specialists in the machining, surface finishing and balancing of round or partly round parts. Your problems are welcome here.

TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Gisholt Machine Company, 1209 E. Washington Ave.
Madison 10, Wisconsin

Gentlemen:

☐ Please send me a copy of your new booklet on extended-payment and leasing plans.

☐ Please have a Gisholt representative call on me.

Name.....*Title*.....

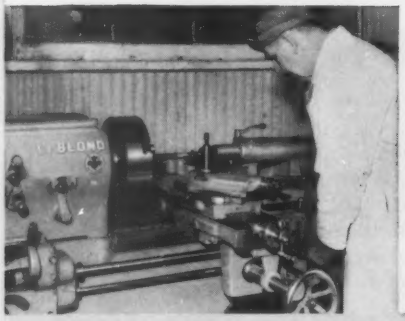
Company name.....

Street address.....

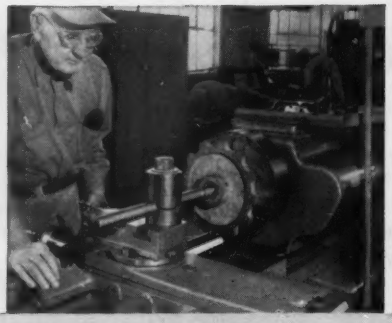
City.....*Zone*.....*State*.....

Versatile LeBlond Lathes Knock Down

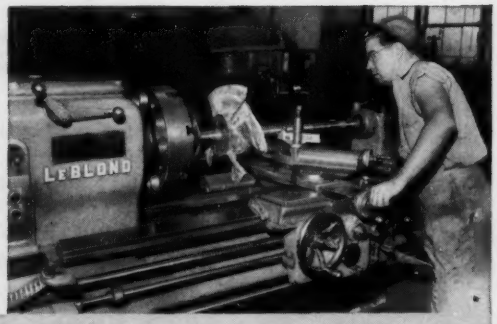
In Chicago, Ill., LeBlond 16" Heavy Duty Engine Lathe finishes 12" steel blank for roller die used in cold roll forming mill at U.S.G.'s Hermosa Plant. Machine does wide variety of maintenance jobs—same day was used to thread slitter arbor for an expanded metal lath machine. T. F. Heneghan, Engineering Supt., says LeBlond Lathe gives U.S.G. "faster maintenance". Ask for Bulletin HD-125-A.



In Norfolk, Va. versatile LeBlond 19" Regal Gap Lathe recuts welded boot scraper shaft. Exacting precision is number one requirement here. Note removable bed section is in place on this job, can be removed to accommodate work up to 27¼" diameter. Ask for Bulletin R-PG-1-A.



In Ft. Dodge, Iowa, LeBlond 17" Regal Lathe bores sprocket to ±.001". Sprocket must fit bearing shaft also turned on the LeBlond. Plant Engineer, John F. Hoertz, says, "This lathe holds tolerances better than previous lathes, saves tool life, speeds up maintenance work . . . ". Ask for Bulletin R-135-A.



In Greenville, Miss., LeBlond 16" Heavy Duty Engine Lathe dresses down shaft for flume return pump, part of the water return system at U.S.G.'s Pressed Board Plant. Other jobs include machining precision bearings for Pelton pump, turning down built-up bushing on universal joint for a steam press—typical of the great variety of turning work now done in U.S.G.'s own shops. Many used to be jobbed out—cost extra time and money. Ask for Bulletin HD-125-A.

"Upkeep" Costs for U.S. Gypsum

16 U.S.G. Plants from Maine to California

depend on LeBlonds for speedy, economical maintenance.

Dozens of turning jobs that used to be "farmed out" by U.S. Gypsum Plants now get done at less cost and *days sooner*, right in U.S.G.'s own maintenance shops—thanks to versatile LeBlond Lathes.

With U.S.G.'s quarry-to-finished-product operation, plant machinery ranges from huge mining equipment—to processing machinery—to speedy conveyors—to intricate packaging machines that bundle up finished products. Who knows what the LeBlond's next "fix-it" turning job will be? Today it's dressing down the shaft of a flume return pump. Tomorrow it's finishing a precision bearing where the critical tolerance goes down to tenths!

Convenience, low cost, dependability, wide variety of work—that's what LeBlond Lathes mean to maintenance men at U.S. Gypsum. And that's why there's at least one LeBlond Lathe on maintenance work in each of 16 U.S.G. Plants—from Maine to California.

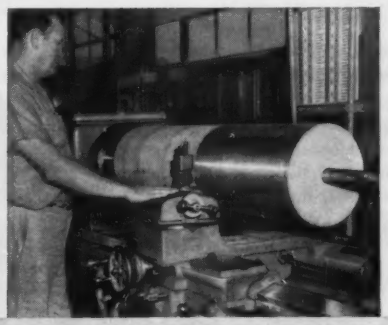
How many of *your* turning jobs did you send out of your plant this month? Is the "other fellow's" profit a large chunk of your maintenance cost?

Call your nearby LeBlond Distributor. Show him the variety of turning work that your maintenance requires. Tell him how long it takes to get it done elsewhere, what it costs. From LeBlond's complete line of 76 different lathe models, he can recommend lathes that will handle all of it—or at least a major portion. You'll get the work done sooner, dependably, and without an outsider's profit to pay for.

For complete information contact your LeBlond distributor or write—

THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

In Alabaster, Mich., LeBlond 24" Regal Lathe threads take-up bolt for 4½ yard Bucyrus-Erie Rock Shovel. Four threads per inch, speed 95 rpm. Plant Engineer, E. John Minderman, says this LeBlond Lathe handles work ranging "from very small parts found in electrical and hydraulic equipment to large gears, shafts and armatures that require the full capacity of the machine". Reports "very dependable service". Ask for Bulletin R-163-A.



In Plaster City, Calif., U.S.G. saves at least seven days by machining this roller on the LeBlond 20" Standard Duty Engine Lathe—right in their own shop. Job used to be sent out, took up to ten days to complete. Another LeBlond Lathe is still in regular use at the Plaster City Plant, after over 25 years of maintenance work. Plant Engineer, R. W. Langewisch, says LeBlond Lathes "save time, expense, increase shop capacity". Ask for Bulletin SD-250-A.

LeBLOND of Cincinnati

World's largest builder of a Complete Line of Lathes—for More than 66 Years.

LARGE

or small...

DAVIS

IS THE FIRST NAME TO CALL WHEN YOUR MACHINING NEEDS

Job-Engineered

SPECIAL TOOL DESIGNS

26 CUTTERS ON THIS SPECIAL TOOL BORE, TURN AND FACE HOLES RANGING FROM 22.500" TO 55.75" IN DIAMETER

2 BLOCK-TYPE CUTTERS IN THIS SPECIAL TOOL ROUGH, FINISH AND COUNTERBORE HOLES RANGING FROM 2.180" TO 2.420" IN DIAMETER

Yes, large or small, simple or complex, you always tool jobs better with Davis. One reason is the big, extra bonus of machining know-how that goes into every Davis tool.

In the design of special tools, like those above, Davis' broad experience and unsurpassed engineering skill assure recommendations complete in every detail of speeds, feeds, fixtures and maximum combination of multiple operations into single tools for increased production at lowest cost.

DAVIS ALSO OFFERS INDUSTRY'S MOST COMPLETE STANDARD TOOL LINE

In standard blocks, boring heads, bars, and tool sets, the Davis line features thousands of items to assure unrestricted selection in tooling up virtually any routine job.

Your local Davis Field Engineer is as close as your telephone, and behind him are the complete facilities of Davis' application engineering department, ready to serve you with special or standard tools.

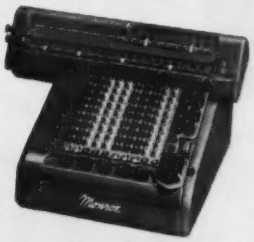
DAVIS BORING TOOL DIVISION of Giddings & Lewis Machine Tool Company
Fond du Lac, Wisconsin

THE ONE NAME THAT CERTIFIES ULTIMATE PRECISION AND PRODUCTIVITY IN TOOLING

For more information on products advertised, use Inquiry Card, page 255

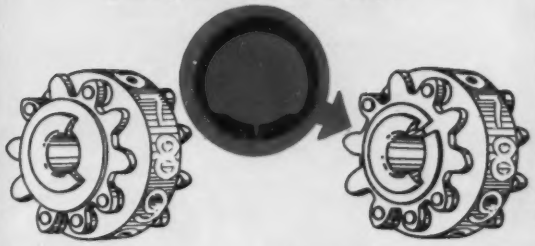
Waldes Truarc rings replace old-fashioned fasteners . . . save assembly time...end scrap loss...increase operating efficiency

This is the Monroe Calculator



...precision-engineered business machine made even more efficient, and less costly to manufacture through the use of Waldes Truarc Retaining Rings.

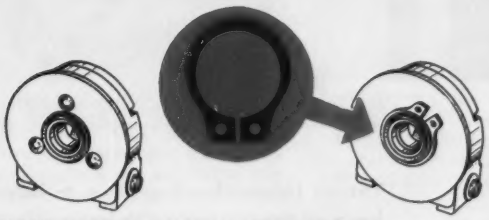
Multiplier Dial Assembly



Old Way. One-piece assembly was spun together. Spinning operation was costly, resulted in high scrap loss.

Truarc Way. Two-piece assembly is held together by one Truarc Ring (series 5108). Rejects: practically zero.

Electric Motor Governor



Old Way. Collector Disc assembly was formerly riveted, requiring skilled labor. Riveted Collector Disc could not be removed in the field.

Truarc Way. Truarc Ring (series 5100) replaces rivets, saves labor, material...improves Collector action. Collector Disc is easily replaced.

Intermediate Gear Shaft

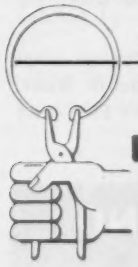
Old Way. Washer riveted on end of assembly for zoning control. Costly, troublesome, hard to obtain critical zoning required.

Truarc Way. Truarc E-Ring (series 5133) cuts assembly time, virtually eliminates rejects and final assembly and zoning problems.

Monroe Calculating Machine Company, Orange, N. J. uses various types and sizes of Waldes Truarc Retaining Rings. Use of Truarc has helped eliminate scrap losses, saved on material and labor, and resulted in increased operating and servicing efficiency of the product. Monroe plans to use Truarc Rings for every possible fastening operation on their entire line!

You, too, can save money with Truarc Rings. Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better, more economical job. Waldes Truarc Rings are precision-engineered...quick and easy to assemble and disassemble.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc Engineers for individual attention, without obligation.



SEND FOR NEW CATALOG

WALDES

TRUARC

REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,382,947; 2,382,948; 2,410,052; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,509,081 AND OTHER PATENTS PENDING

For precision internal grooving and undercutting...Waldes Truarc Grooving Tool!

M017

Waldes Kohinoor, Inc., 47-16 Austel Pl., L. I. C. 1, N.Y.

Please send me the new Waldes Truarc Retaining Ring catalog.

(Please print)

Name .....

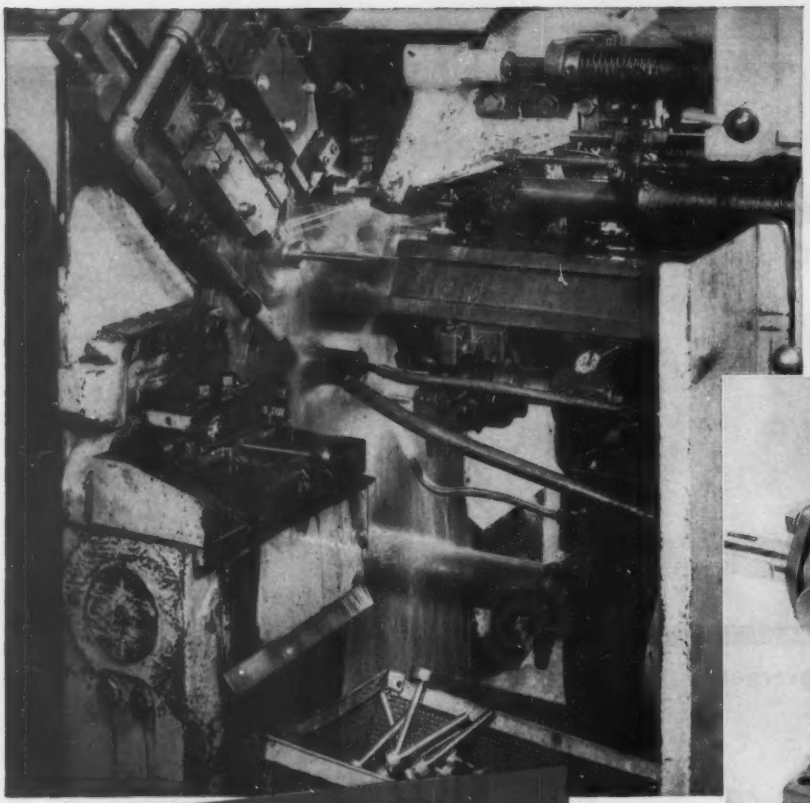
Title .....

Company .....

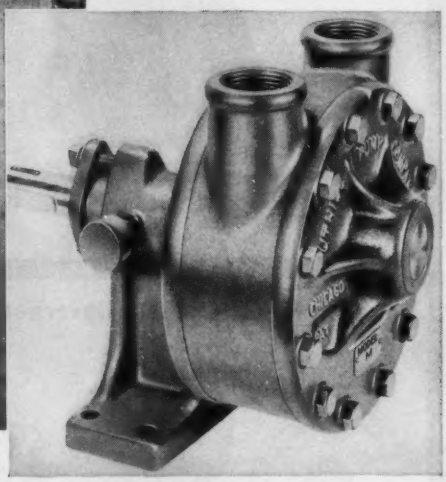
Business Address .....

City ..... *Zone* ..... *State* .....

For more information on products advertised, use Inquiry Card, page 255



AUTOMATIC screw machine producing parts for Tuthill industrial pumps, like the typical Model M shown below. Dual-purpose *Texaco Cleartex Oil B* has been used successfully for seven years as cutting oil and machine lubricant.



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By LORING F. OVERMAN

Preparedness Plans Are Uppermost

IF Washington is not prepared for a future emergency, it will not be because folks are not trying to solve the problem. The lengths to which Washington agencies, commissions, task forces, study groups, and others are going in order to be ready are highlighted in the fourth annual report of the Congressional Joint Defense Production Committee. As usual, however, the kaleidoscopic nature of the problem continues to confound the experts. The current report, a 252-page affair, includes an appendix which outlines the progress made by each of the agencies assigned duties under the Defense Production Act.

Government Plants?

One conclusion is that additional legislation may be sought during the coming Congress to authorize the Government to build defense plants or to stockpile military end items or components in cases where present inducements are not sufficient to interest private industry to do the whole job. The Committee reported that of 224 expansion goals set for industry, 128 have been achieved, 28 others are 90 per cent or more achieved, 46 are between 50 and 90 per cent achieved, and only 22 are less than 50 per cent achieved.

"Of the total 96 goals remaining open," the Committee observed, "some have reached the point, according to the Office of Defense Mobilization, where it may require greater incentive than normal accelerated tax amortization to get industry to undertake the necessary expansion to cover the deficiencies noted."

Machine Tool Leasing Discussed

The Committee report was particularly insistent that the ODM and other responsible agencies get together promptly to develop some uniform plan with regard to the leasing of machine tools to defense contractors. "While your Committee appreciates that there are many angles to this problem," the Committee statement says, "it does feel that positive action should be taken toward establishing a leasing program that more equitably meets the needs of both industry and Government. Furthermore, all Government contractors are entitled to a uniform policy."

Freeze Still Impends

In the ODM section of the appendix, it was reported that there still is a complete plan for a ninety-day freeze of the economy in the event of an attack on the United States. Legislation has been drafted, together with a modernized ceiling price regulation, for submission to the President and Congress within hours of any emergency.

The Committee also pointed out that the Defense Department has submitted to ODM a list of some 1000 military items and components which would be needed during the first three years of an all-out war. These data are serving as a guide in reconsidering the mobilization base program, and in revising some of the past plans. The report indicated that several bottlenecks have been spotted, and that vigorous action is being taken for their removal.

BDSA Opposes Tool Leasing

The Business and Defense Services Administration, in its section of the appendix, vigorously opposed the leasing of government-owned machine tools, with the possible exception of the so-called elephant types, for any non-defense activity. "While it is recognized," says BDSA, "that such leasing provides the Government with a temporary financial advantage through a modest (presently sub-standard) rental income, and tends to defer some storage and maintenance costs, it is clear that in most instances the disadvantages outweigh the gains." The objections are as follows: (1) Such leasing would dissipate the mobilization base potentials; (2) it would ultimately cost the taxpayer more to maintain a given level of preparedness; (3) it would provide an unfair competitive advantage to selected manufacturers; and (4) it would perpetuate and increase the Government's participation in business, notwithstanding the present Administration's emphasized policy to the contrary.

Washington Briefs

DURING the first six months of 1954, the Defense Department declared as surplus, material having an acquisition value of more than $1,000,000,000. About $700,000,000 worth of material was disposed of at 7 1/2 cents on the dollar. The announcement was made by Carter L. Burgess, holder of a recess appointment as Assistant Secretary of Defense for Manpower. The problem of military surplus will be a continuing one, Mr. Burgess said. "Within the last four years we have introduced into our supply system over $50,000,000,000 worth of material. We have procurement authority for $37,000,000,000 more. Every pound of this material will have to be expended from our system, and barring a war, most of it will go out via the route of surplus material disposal as the inexorable processes of deterioration and obsolescence take their toll."

UNDER the title "Ordnance" (PB111469), the fifth of a series of seven patent abstract publications, prepared from the Index of Inventions maintained by the Government Patent Index Board, is now ready for distribution. The book contains 644 listings of interest to plants engaged in or capable of producing ordnance items. The book may be purchased at $2 from the Office of Technical Service, Room 6227, Commerce Bldg., Washington 25, D. C. Another patent abstract of particular interest to the machinery industry is entitled "Metal Processes and Apparatus, Machinery, and Transportation Equipment." It is also $2.

NAVY'S share of the first $100,000,000 allotted for machine tool purchases under the Vance plan will be $14,270,470. The Air Force was allotted $84,000,000 and the Army, the balance. The Navy has announced that its share will be used to purchase lathes, milling machines, boring mills, gear-cutting machines, and a few high-precision instrument-making tools.

THE ODM, feeling that maintenance of a broad mobilization base may sometimes require the award of a procurement to other than the low bidder, has issued Amendment 2 to DMO VII-7. The amendment deletes a provision, "The general policy in cases where suppliers who are a part of the mobilization base are unable to compete successfully on a bid basis shall be to re-examine the mobilization base to determine if the capacity can be maintained without inclusion of high-cost producers."

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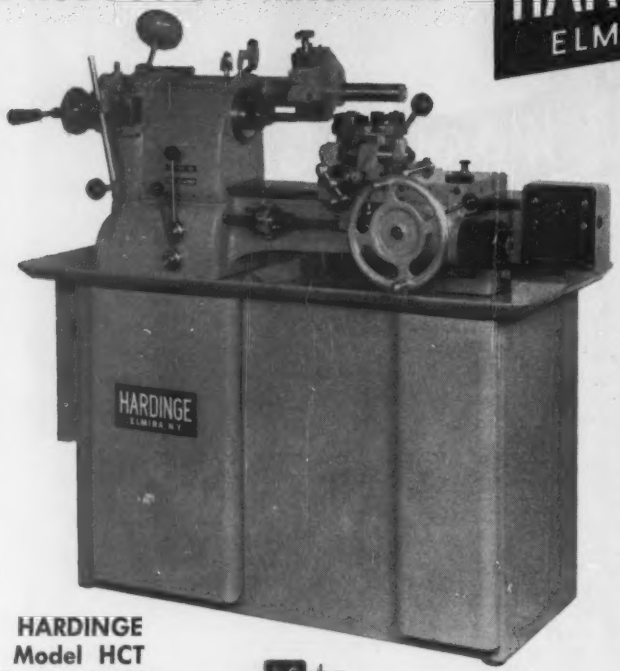

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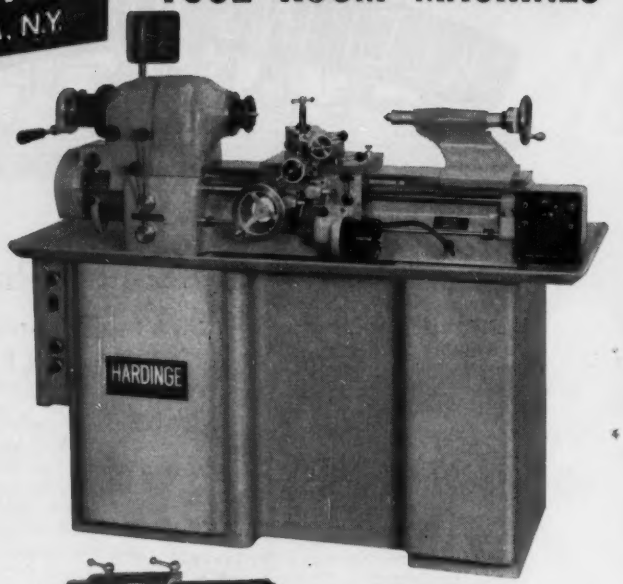

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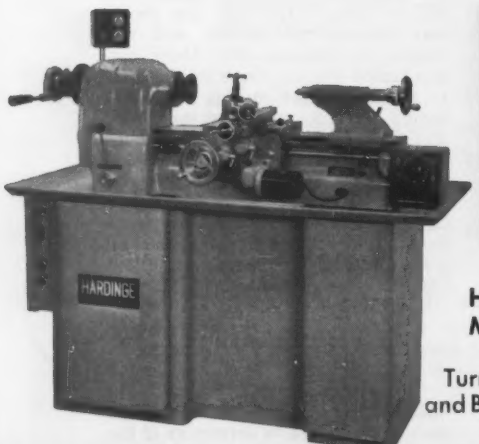

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A Great Year to Carry Out Modernization Programs

PROGNOSTICATORS of the immediate economic future predict that 1955 will be a year of prosperity—better than 1954, although probably not reaching the all-time highs of 1953. Some expert economists go so far as to say that 1956 could conceivably be another boom year.

It appears most appropriate, therefore, that the National Machine Tool Builders' Association has selected the year 1955 as the one in which to display on a grand scale the machine tools that have been developed in this country since the 1947 Show. And the developments have been tremendous during this eight-year interval!

Advances in electronic controls and in hydraulic and pneumatic devices have enabled machine tool designers and builders to produce equipment of the automation type far beyond the vision of production men only a few years back. Who would have believed at the time of the last Machine Tool Show that in 1955 there would be in existence a transfer machine 350 feet long. A machine that performs a total of 550 operations on engine cylinder blocks, including automatic mechanical inspection, without the cylinder blocks being touched by human hands from start to finish. Electronic controls "mastermind" all operations and flash warning lights when anything goes wrong. Twenty-seven miles of electric wire are required for this machine.

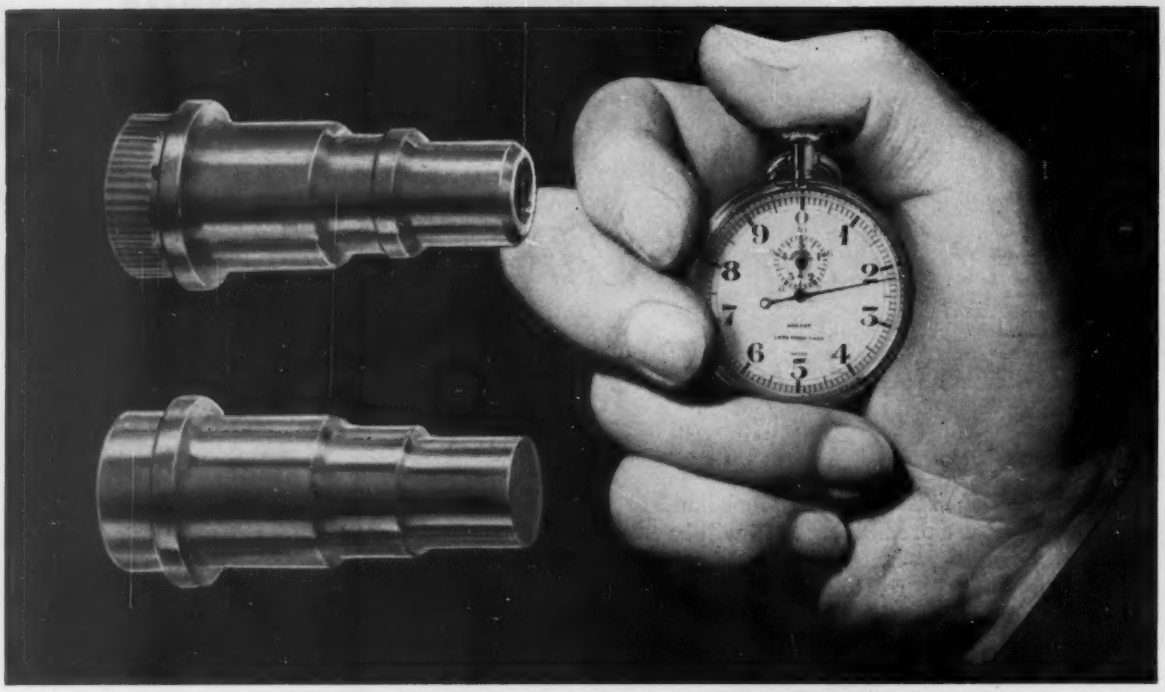
By no means have machine tool developments been confined to automation equipment. Lathes have been produced by a number of concerns with refined types of tracer controls that facilitate the accurate duplication of work-pieces. Right-angle lathes have been brought out for the fast turning and facing of large disc-like work-pieces. Modern machines have made the art of spinning applicable to the alloys used in jet-engine manufacture. Parts can be formed within a tolerance of 0.002 inch by these new machines; and on the softer metals, material as thick as 1/2 inch can be handled.

Striking improvements have actually been made in every type of machine tool, the ingenuity of engineers and designers in all fields of the industry having been exercised to an unprecedented degree. Visitors to the Machine Tool Show will therefore have a greater opportunity than ever before of obtaining ideas for the manufacture of their own products at lower costs.

The urge for modernization throughout the metal-working industry should receive impetus from the realization of what the American machine tool industry builds today. A prosperous year throughout all facets of the Nation's economy should hasten the elimination of obsolescence in many industrial plants because money will be available to buy the latest production equipment.

Charles O. Herb

EDITOR



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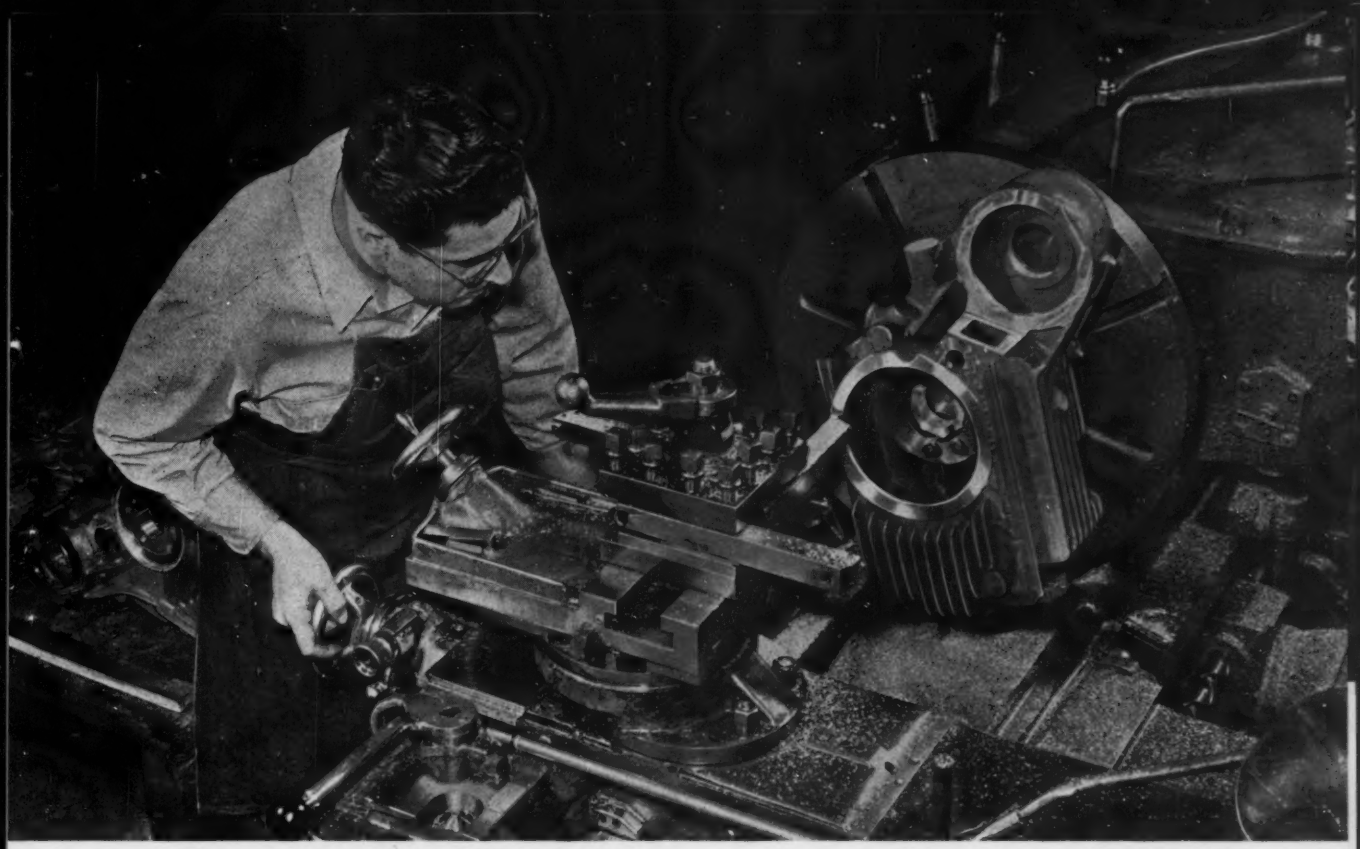


Sub-Contract Plant Tooled Up for Aircraft Parts

Modern machine tools and production methods work hand-in-hand to produce large quantities of precision aircraft components. Rigid inspection requirements must be met to assure the satisfactory performance of each part during its normal span of life

By W. W. GREENWAY
Vice-President and General Manager
Axelson Mfg. Co., Division of U. S. Industries, Inc.
Los Angeles, Calif.

WITH modern aircraft attaining ever higher speeds and encountering increasingly adverse operating conditions, the demand for precision-built structural members and other components has challenged the ingenuity of American production methods. This challenge has been more than adequately met by prime aircraft manufacturers and subcontract manufacturing concerns alike.

The Aircraft Division of the Axelson Mfg. Co., Division of U. S. Industries, Inc., located at Montebello, Calif., is engaged in just such subcontract manufacturing. Modern machines turn out landing-gear shock struts, cabin superchargers for high-altitude flying, airfoil segments, bulkhead segments for fuselages, and other components requiring close limits of accuracy. This article will describe typical operations.

A typical Axelson gap-bed lathe set-up may be seen in Fig. 1. In this operation, the wheel bear-

Fig. 1. Turning bearing diameter of a landing-gear strut on a 100-inch swing Axelson gap-bed lathe. Faceplate fixture is counterbalanced due to uneven weight distribution of set-up.

ing diameter on the axle of a landing-gear strut is being turned. When used as a conventional lathe, the machine has a 32-inch diameter swing, but with the gap opened up, a 100-inch swing is provided. A 64-inch swing is required for the strut shown in the illustration.

The axle is forged integral with the strut from either S A E 4130 or 4140 chrome-molybdenum steel. Turning the tapered portion of the axle follows, after which the strut extension is flash-welded in place to form the single unit. This set-up presents an extremely unbalanced load. To offset this condition, a steel weight is bolted to the faceplate at a point opposite the overhang of the work-piece.

Tungsten-carbide cutters are used, and a surface finish ranging from 50 to 60 micro-inches r.m.s. is maintained. Six different tools are employed to complete the turning operations on this strut. All six tools are set up in individual tool-blocks which are, in turn, held in a Bakewell quick-change tool-holder. Changing tools from one operation to the next is accomplished in a matter of seconds, and the part is turned in a

Fig. 2. Landing-gear pistons are ground to close limits of accuracy on this 86-inch swing Norton gap grinder. The piston is integral with the extension arm and axle.

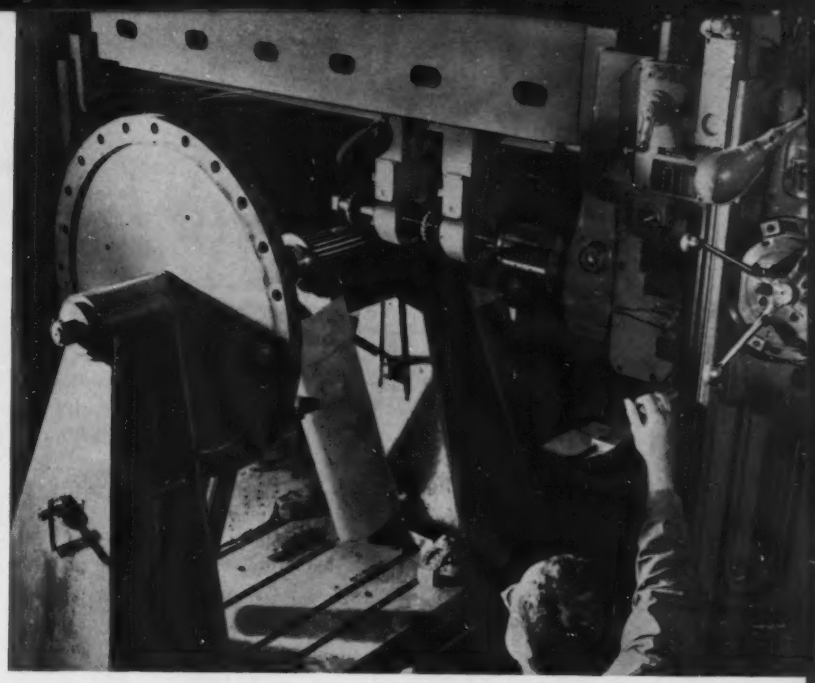


Fig. 3. A twenty-four-tooth spline is milled and chamfered on a Giddings & Lewis horizontal boring mill. The landing-gear strut is held between centers in a hand-indexing fixture.

floor-to-floor time of approximately fifty-four minutes. Many types of struts are subsequently ground to maintain a tolerance of plus or minus 0.001 inch.

A Norton gap grinder with an 86-inch swing is shown in Fig. 2 being used for grinding a series of external dimensions on the piston assembly of a main landing-gear strut. The operations include the grinding of five diameters, one 0.093-inch corner radius, and one shoulder face. Grinding is maintained within a tolerance of plus 0.000 minus 0.001 inch.

Following these grinding operations, which are completed in 1.021 hours, the struts go through a series of milling, threading, boring, reaming, and chromium-plating operations. They are then returned for finish-grinding. An Arnold gage contacts the work while the grinding is in progress to inform the operator when the desired dimension has been reached.

Machining a twenty-four-tooth spline, Fig. 3, on the axle section of a piston assembly for a large aircraft landing strut is easily handled on a 5-inch diameter spindle Giddings & Lewis horizontal boring mill. Each tooth on the 4.969-inch diameter spline must be aligned with the center line of the piston within 0.002 inch. To accomplish this, the strut is located between centers on a hand-operated indexing fixture which has approximately a 7 to 1 reduction. This provides highly accurate tooth location and spacing. Each spline tooth is milled individually. Following completion of the last tooth, the table is reset and the teeth are chamfered.

Trunnion bearing holes, about 7/8 inch in diameter, are line-bored on another Giddings & Lewis horizontal boring mill. A main landing-gear strut, intended for use on a jet bomber, is located in a boring fixture mounted on a rotary table, Fig. 4. The bore is 20 inches long, of which

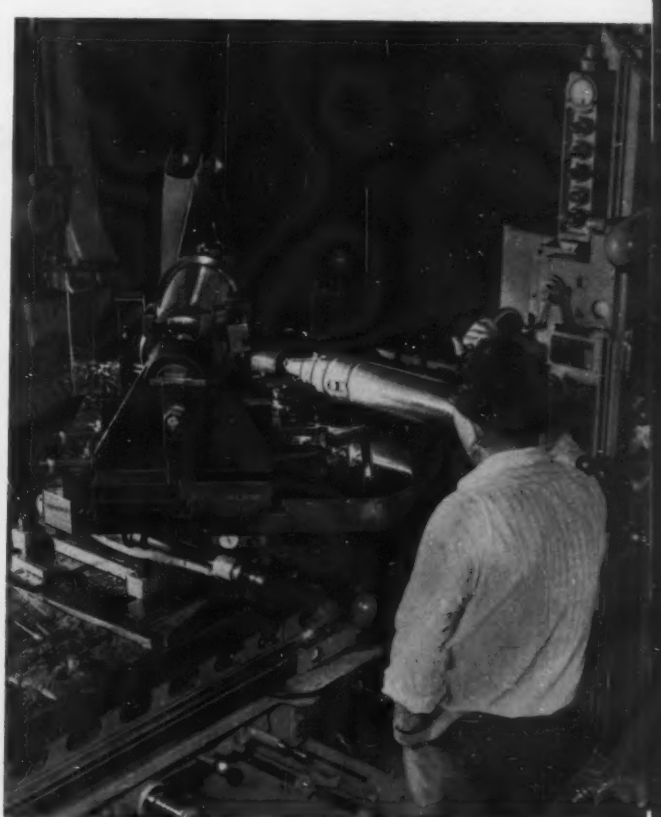


Fig. 4. Line-boring bearing seats on a horizontal boring mill. A diametrical tolerance of plus or minus 0.0005 inch is held along the length of the 5-inch deep bearing bores.

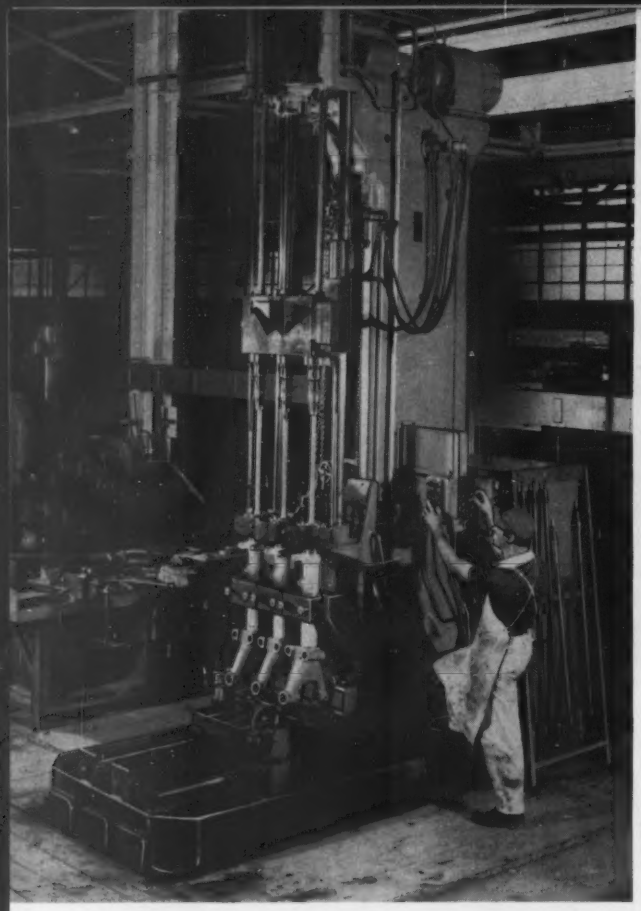


Fig. 5. Micromatic hones are employed on a Barnes three-spindle honing machine. The machine applies the finishing touch to three 20-inch long by 3 3/4-inch diameter blind bores at the same time.

5 inches at each end is held to a tolerance of plus or minus 0.0005 inch. Alignment between the two precision bored bearing seats must be held within plus or minus 10 minutes of arc. The accuracy with which the machining operations on this unit are carried out may be realized by noting the three dial indicators employed: one for gaging the vertical movement of the head; another for gaging the horizontal movement of the work-table; and still another for gaging the angular movement of the rotary table.

Final sizing of cylinder bores is performed on the Barnes three-spindle honing machine seen in Fig. 5. The bore, which is 20 to 22 inches long and 3 3/4 inches in diameter, is a blind hole. However, a small opening passes through the end wall of the bore and provides drainage for the honing lubricant. Micromatic hones are used for the operation.

Side plates of a tail-wheel strut assembly are shown being machined in Fig. 6. The parts are made from 7075-T (75S-T) aluminum plates and are being profiled on a four-spindle vertical Hydro-Tel milling machine in the illustration. At the right-hand side of the head may be seen the follower, template, and a profiling attachment. Metal removal is accomplished by high-speed steel, ball-nose end-mills. Not only is the peripheral contour of the work-piece profiled, but also two elongated recesses are profile-milled in one face of the plate.

After the plates are completely machined, bored, anodized, and painted, they are carefully inspected and delivered to the assembly area. In this section of the plant, Fig. 7, the various components are combined to form sub-assemblies, and then, finally, the completed strut assembly. The particular strut shown will be used as the tail-wheel landing gear on a carrier-based Navy fighter plane.

The ability of the finished product to withstand the punishment to which it will be subjected throughout its normal lifetime can only be assured by rigid inspection of each component during its manufacture. A typical inspection of main landing-gear hydraulic cylinders is shown being performed in Fig. 8.

Fig. 6. Profiling aluminum side plates for tail-gear assemblies on a Cincinnati Hydro-Tel. The operator is adjusting the coolant flow to each of four ball-nose end-mills.

Fig. 7. Assembling tail-gear components into finished units for Navy fighter planes. Solid rubber wheels denote carrier-based operations for the aircraft.

Besides being inspected for dimensional accuracy, welded members must pass torturous physical tests. A Baldwin-Southwark hydraulic testing machine, Fig. 9, is used to test the welds for soundness. Loads up to 440,000 pounds per square inch are applied. This testing machine may be used for applying either tensile or compressive loads.

The profiling operation on an aircraft strut may be seen in Fig. 10. The follower is tracing the outline of a wooden master pattern that is mounted on the right-hand side of a Cincinnati

Fig. 8. Rigid inspection is required during the manufacture of aircraft parts that are to be used under such punishing conditions as those that are encountered by landing gear aircraft.

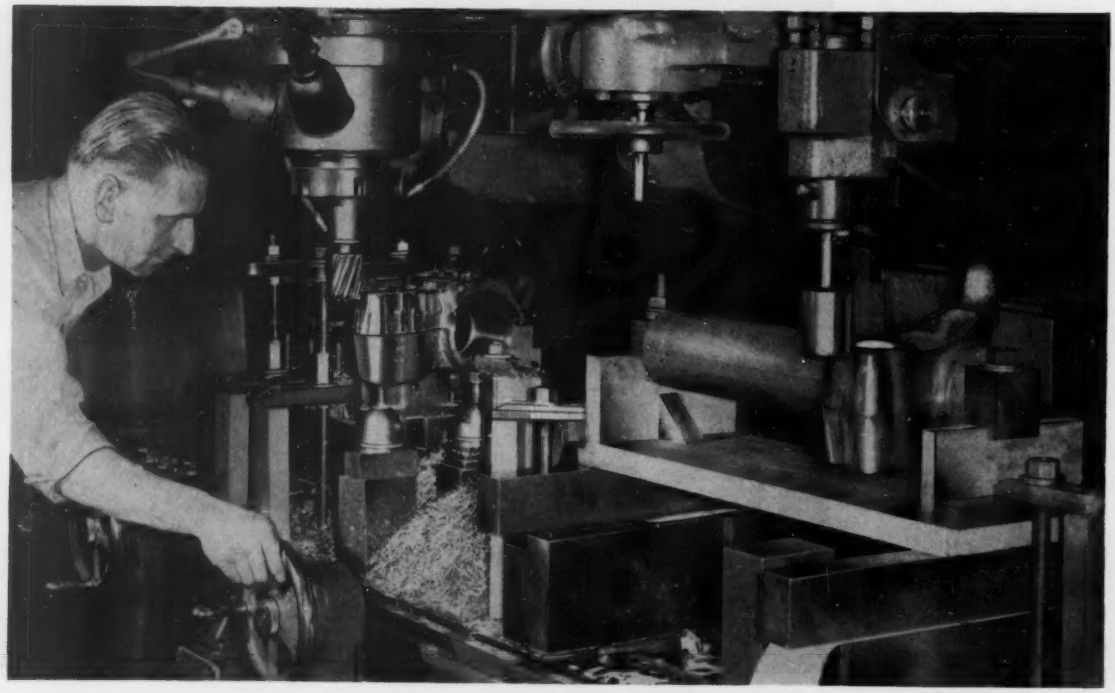
Fig. 9. Weldments undergo vigorous tests to determine soundness of the welds. Here, a Baldwin-Southwark hydraulic testing machine applies a load of about 440,000 pounds per square inch.

Hydro-Tel. On production runs, forgings are first turned and bored on a lathe, then profiled where necessary. With prototype jobs, however, the strut is hogged out of a solid forged-steel block. Forging of these parts is necessary to provide the dense, uniform structure needed for the heavy shock loads to be imposed upon them in service.

Line-drilling of two lugs on an integral piston and axle unit is shown in Fig. 11. This drilling is to be followed by a line-boring operation. The work is being held in a temporary set-up on a Lucas horizontal boring mill. Because this is a prototype part, the holding arrangement seen suffices. At a later date, when production runs are scheduled, a fixture will be supplied.

Landing-gear components are not the only aircraft units manufactured at this plant. Structural segments, such as the one in Fig. 12, are

Fig. 10. A forged-steel aircraft strut is shown being profile-milled on a Cincinnati Hydro-Tel. The contour is traced from an accurate master pattern constructed of wood. This wooden pattern may be seen at the right.



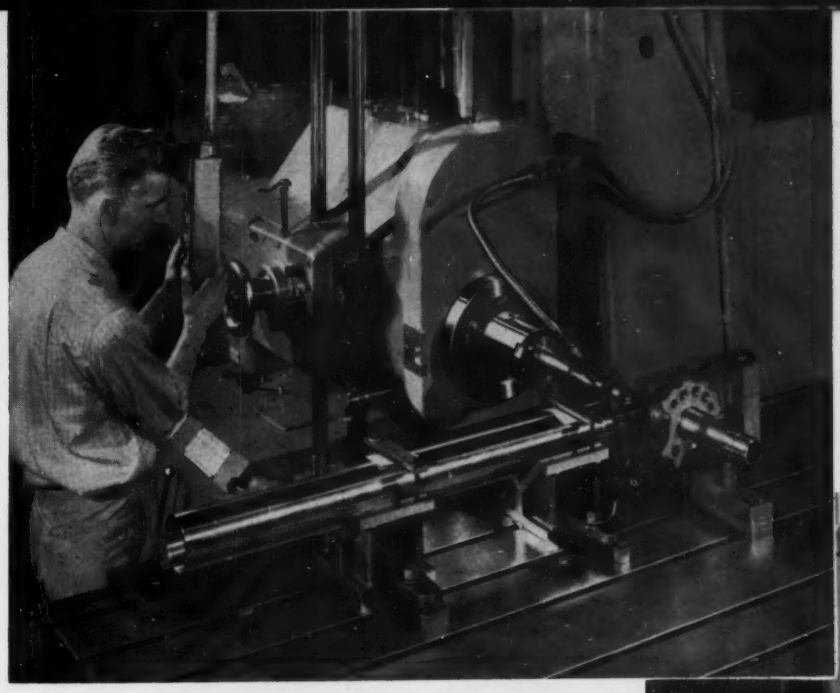


Fig. 11. (Left) Drilling and boring in-line holes through two lugs on a Lucas horizontal boring mill. Since this is a prototype job, no milling fixture is used.

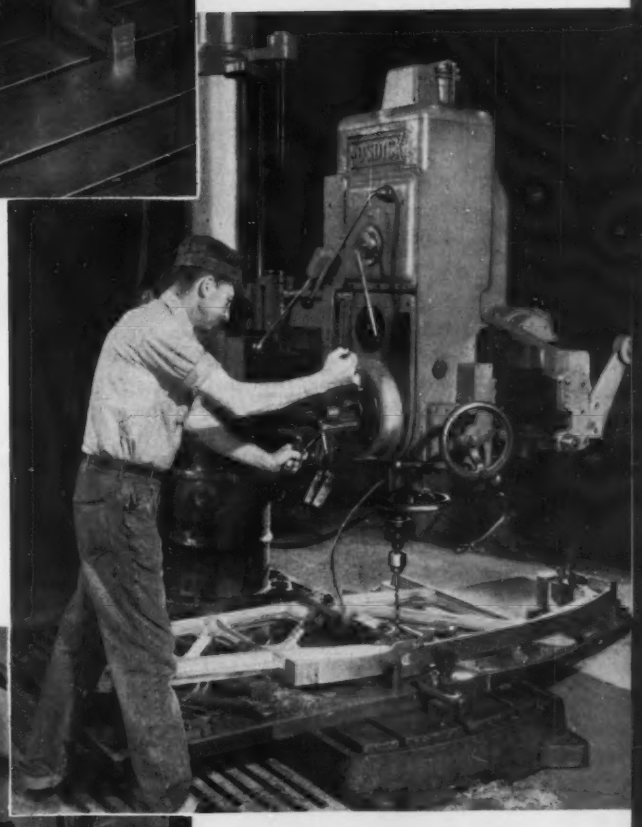


Fig. 12. (Right) A two-part structural segment is lined up in a drill jig on a Fosdick radial drill press. Holes are drilled and reamed and dowel-pins are inserted before unclamping the segment.

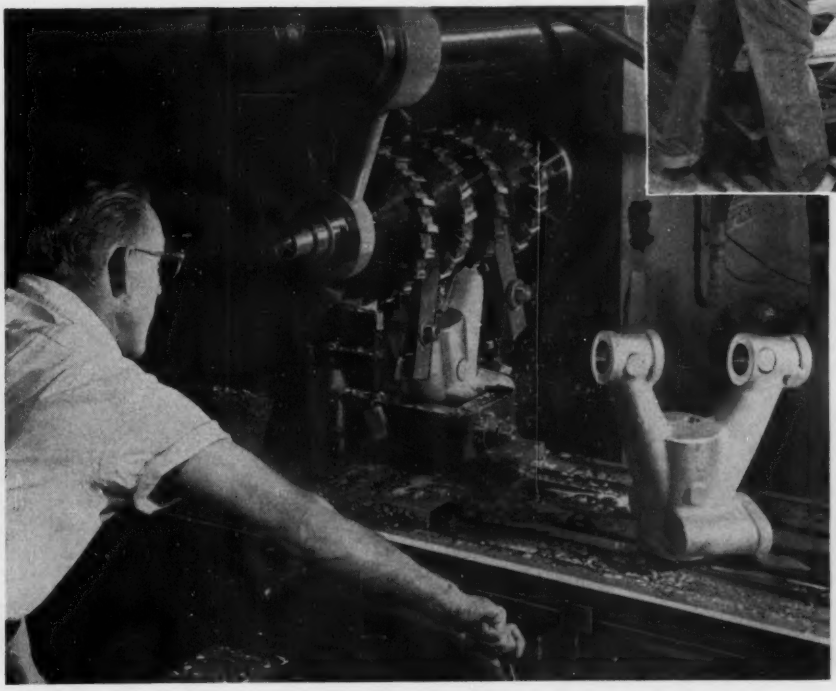


Fig. 13. (Left) The bosses on cast-aluminum main-gear trunnions are being straddle-milled on a Kearney & Trecker plain milling machine. Special fixture aligns the trunnion bore end-milled bosses within plus or minus 0.001 inch.

also produced in quantity. This aluminum member will be located in a Boeing aircraft at the point where the wing joins the fuselage.

This unit consists of two parts which are held in correct alignment by the drill jig shown. While located in the jig, holes common to both sections are drilled and reamed to diametrical tolerances of plus or minus 0.0005 inch. The center-line tolerances, however, are comparatively liberal, being plus or minus 0.010 inch. Dowel-pins are driven in place before the set-up is broken.

Cast-aluminum main-gear trunnions are straddle-milled on a Kearney & Trecker horizontal plain milling machine, Fig. 13. Four 10-inch diameter inserted-blade side milling cutters machine both sides of two trunnion bosses simultaneously to maintain accurate spacing and alignment. The castings, which have been rough-bored prior to this operation, are located in their central bored hole on a special fixture, and aligned by placing a bar in the 2-inch diameter trunnion bores. Floor-to-floor time is fifteen minutes.

Contour-milling of a 7075-T aluminum landing-gear support is being performed on the Pratt & Whitney "Kellermatic" seen in Fig. 14. This machine is one of seven used for intricate contour-milling operations. Cuts are controlled by the action of a follower on the wooden profiling template mounted above the work-piece. Parts come to this machine after being previously rough-profiled, heat-treated, and straightened. Two cuts are taken during this finish-profiling set-up. The first cut is brought to within 1/16 inch of the completed shape, after which it is finish-milled to size.

A main landing-gear strut is located in a test fixture, Fig. 15, which is used for pressure-cycling and final pressure-testing. Pressures of 1500 pounds per square inch are employed for the test. A five-minute static load test, to which each strut is subjected, is shown being recorded. This test fixture is of the universal type and may be set up to accommodate all styles of landing-gear struts.

Fig. 14. Ribs of a cast-aluminum segment are being milled (bottom) on a Pratt & Whitney "Kellermatic." Machine movement is guided by a profiling template and follower (top).

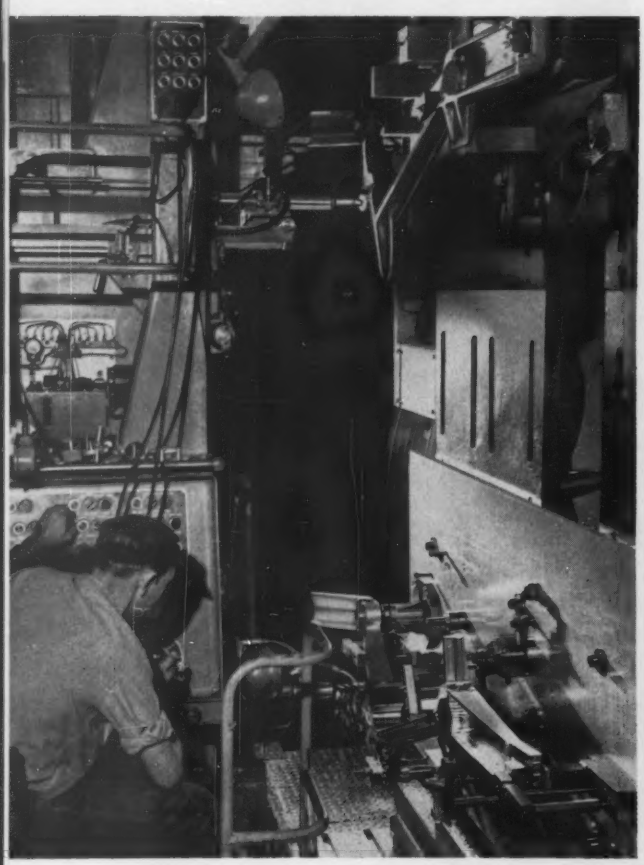
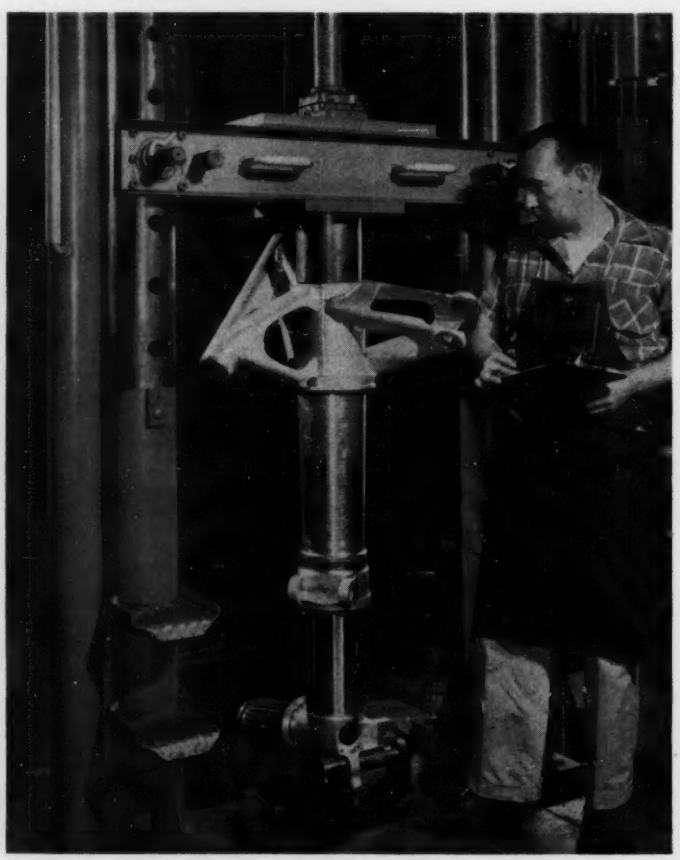
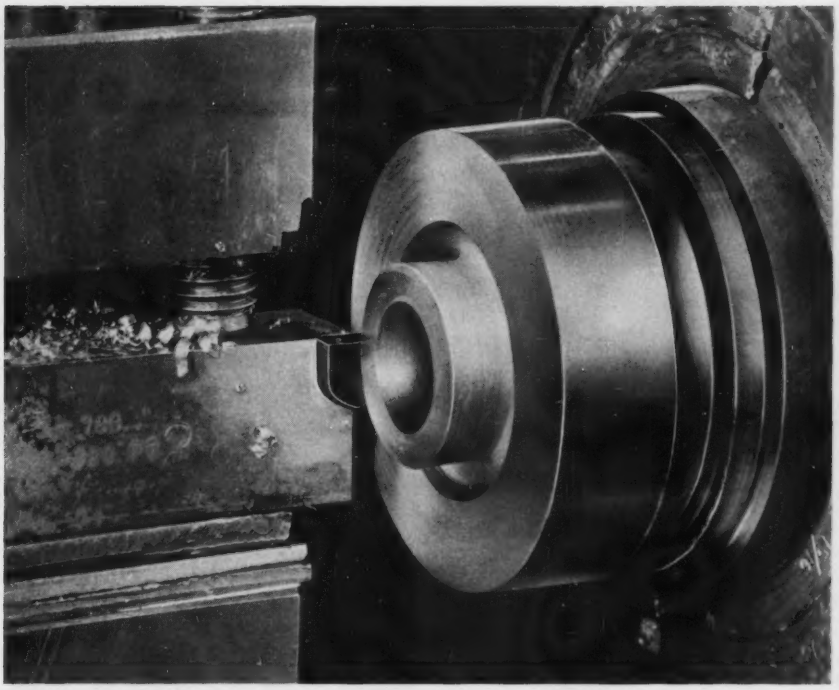


Fig. 15. Pressure-testing a landing strut on a universal testing and cycling machine. The test is performed under a pressure of 1500 pounds per square inch.





Advantages of Side- and End-Brazed Carbide Tools

By D. C. Chisholm
Aircraft Accessory Turbine Department
General Electric Co.
Schenectady, N. Y.

FIVE major benefits have been obtained in manufacturing aircraft turbine parts at the General Electric Co., Lynn, Mass., by using carbide-tipped tools on which the carbide blanks are brazed either on the side or end of the shank instead of in a recessed pocket on top of the shank. Specifically these advantages are: increased tool strength, lower initial cost, lower maintenance cost, reduced diamond wheel wear, and smaller inventories of carbide blanks.

With any carbide-tipped tool, strength is directly proportional to the combined thicknesses of the carbide blank and the steel section of the shank that supports the blank. When the blank is located on the side of the tool, the thickness of both the carbide tip and the shank can be increased without affecting the over-all height of the finished tool. When the tool is of maximum size for a particular toolpost, and yet fails due to lack of strength, it is usually necessary to decrease either the feed or the depth of cut, or perhaps both. In most instances, however, with the use of side- or end-brazed tools, more of the machine horsepower may be utilized.

Since this type of tool is stronger, a smaller shank size may be used than would be possible if a top-brazed tool were used, provided all other machining factors remain unchanged. This, of course, means that the initial tool cost will be lower.

Cost reduction is also realized because only two simple milling cuts are necessary on the shank and an easy sharpening operation on the carbide cutting edge. The milling cuts produce the front and side clearance angles. A secondary clearance angle on the side of the carbide blank need not be ground, as it is provided by the cuts taken previously on the steel shank.

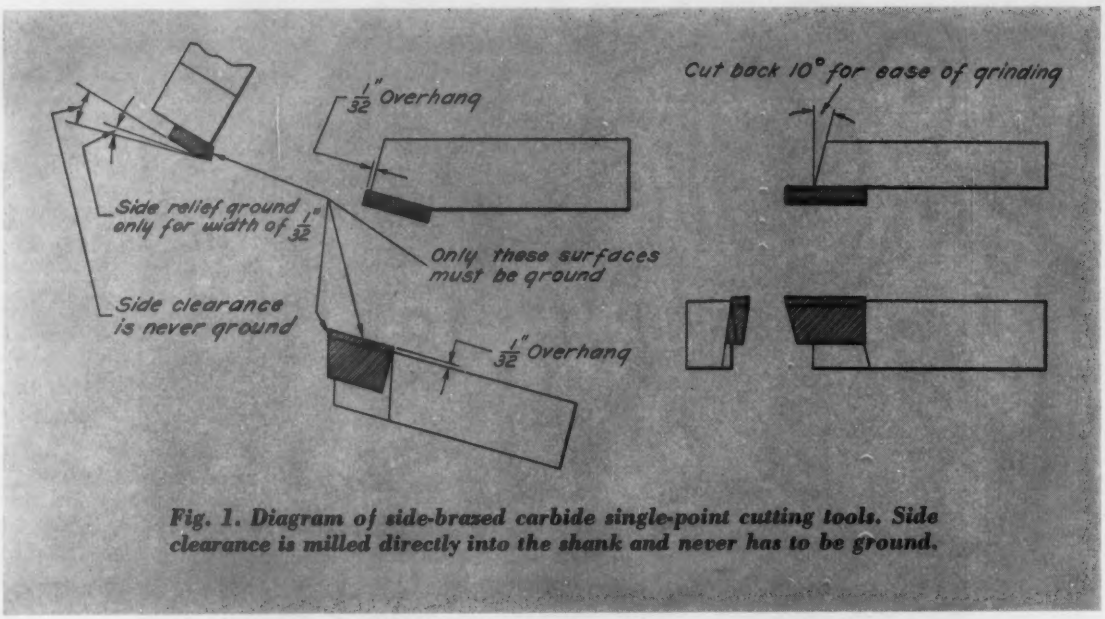

Cut back 10° for ease of grinding
1/32" Overhang
Side relief ground only for width of 1/32"
Only these surfaces must be ground
Side clearance is never ground
1/32" Overhang

Fig. 1. Diagram of side-brazed carbide single-point cutting tools. Side clearance is milled directly into the shank and never has to be ground.

Typical side-brazed carbide tools are shown diagrammatically in Fig. 1. The blank is brazed in such a position that it overhangs the steel shank 1/32 inch on both the top and front surfaces. An end-brazed carbide tool is shown diagrammatically in Fig. 2. In this case, the insert also extends 1/32 inch above the top surface of the shank. Besides providing clearance during machining, the overhang also prevents the possibility of the diamond wheel contacting the shank during tool grinding. After the tool has been ground for the second time, assuming that a tool wear of 1/64 inch is allowed between grinds, the tip may be merely heated with a torch and the insert slid up and forward 1/32 inch.

The time required to relocate the carbide blank is more than offset by the reduction in time needed to regrind the tool. This is due to the fact that only the relief angle on the blank must be reground, as the clearance angle is permanently milled on the side of the tool shank. The top of the carbide blank presents a much smaller area to the diamond wheel than does the same surface of a top-brazed tool, and can therefore be ground much faster. If a chip-breaker is ground in the blank, no other finishing operation is necessary on the top surface.

The steel shank of the top-brazed tool is ground on an aluminum-oxide wheel and finish-ground on a diamond wheel. By contrast, the side-brazed tool needs no grinding on the steel shank, and the blank can usually be reground with a finish diamond wheel. This is possible because the area of the reground tip is approximately one-third that of a top-brazed tool.

More regrinds are possible from this type of tool since more of the carbide tip is utilized for cutting. On a side-brazed tool, more of the tip

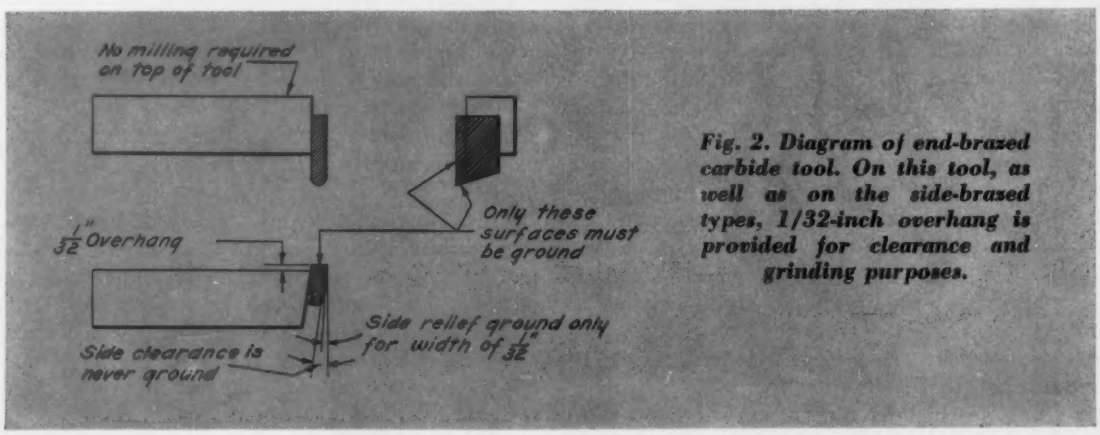

No milling required on top of tool
Only these surfaces must be ground
1/32" Overhang
Side relief ground only for width of 1/32"
Side clearance is never ground

Fig. 2. Diagram of end-brazed carbide tool. On this tool, as well as on the side-brazed types, 1/32-inch overhang is provided for clearance and grinding purposes.

contributes to the strengthening of the tool. When a carbide blank finally fails in operation and must be discarded, the shank is retained because it is still in its original condition. A new blank need only be brazed in place of the old one.

This type of tool has been most successful when used for machining narrow grooves. In the case of grooves ranging from 1/32 to 3/8 inch wide, it is impractical to expect the narrow portion of steel supporting the carbide blank on a top-brazed tool to withstand the heavy cutting pressures involved. For example, on a 1/4-inch square shank ground as a 1/16-inch wide grooving tool and fitted with a 1/16-inch thick carbide tip, only 3/16 inch of steel height can support the blank. With a side-brazed tool, however, the total height of the carbide blank can be 1/4 inch, which will be sufficiently strong.

Illustrated in Fig. 3 is a boring operation on a vertical boring mill. High-temperature alloy steel is being cut with a side-brazed tool. Prior to this, top-brazed tools failed consistently unless the depth of cut was substantially reduced.

A contouring operation, Fig. 4, illustrates another application of a side-brazed tool. The purpose of the ledge beneath the carbide blank is to

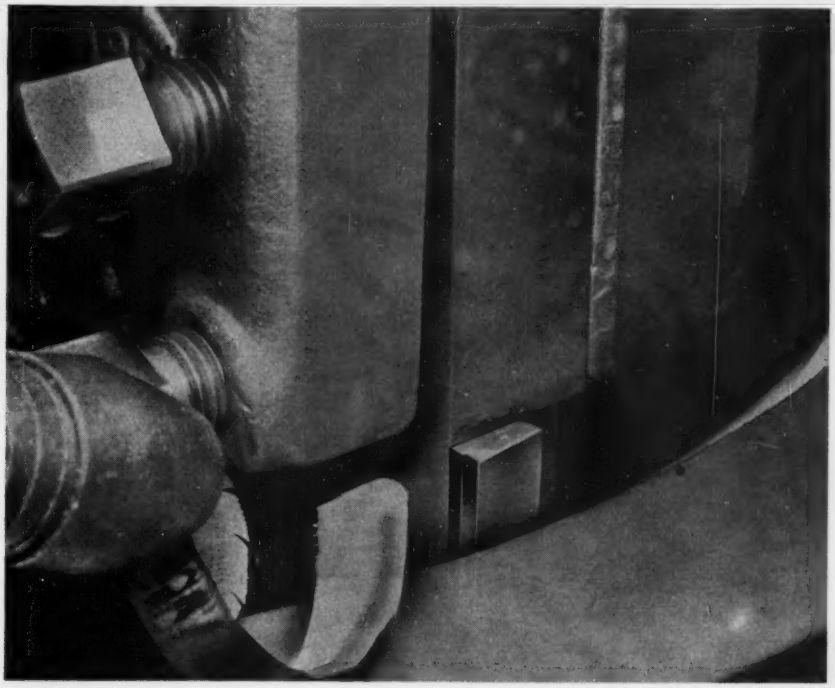


Fig. 3. (Left) Heavy facing cut is being taken on a high-temperature alloy-steel work-piece. Side-brazed cutting tool stands up well during this vertical boring mill operation.

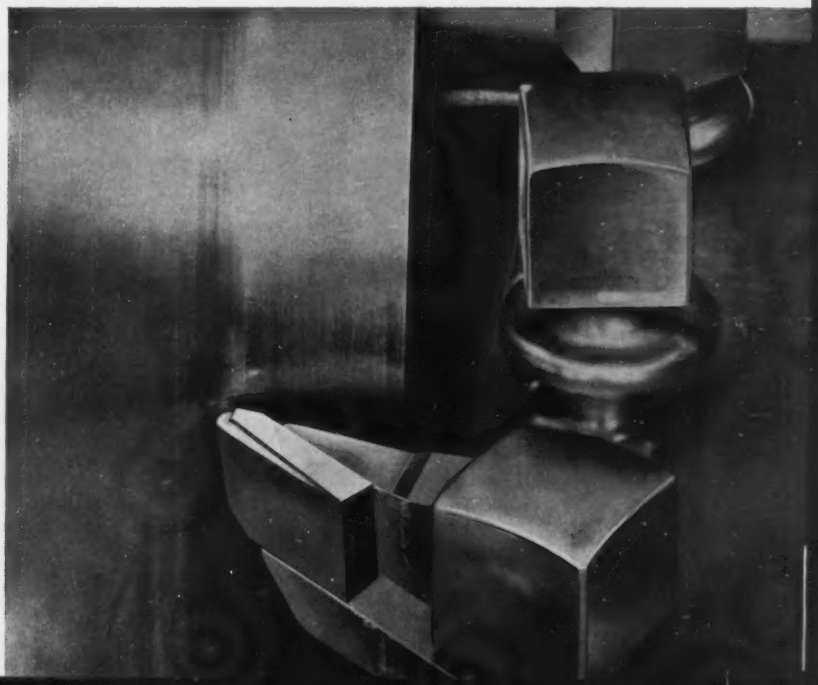


Fig. 4. (Right) Contour-turning operation being successfully performed with a side-brazed tool bit. Failure on the part of the previously employed cutting tools at this point generally resulted in scrap.

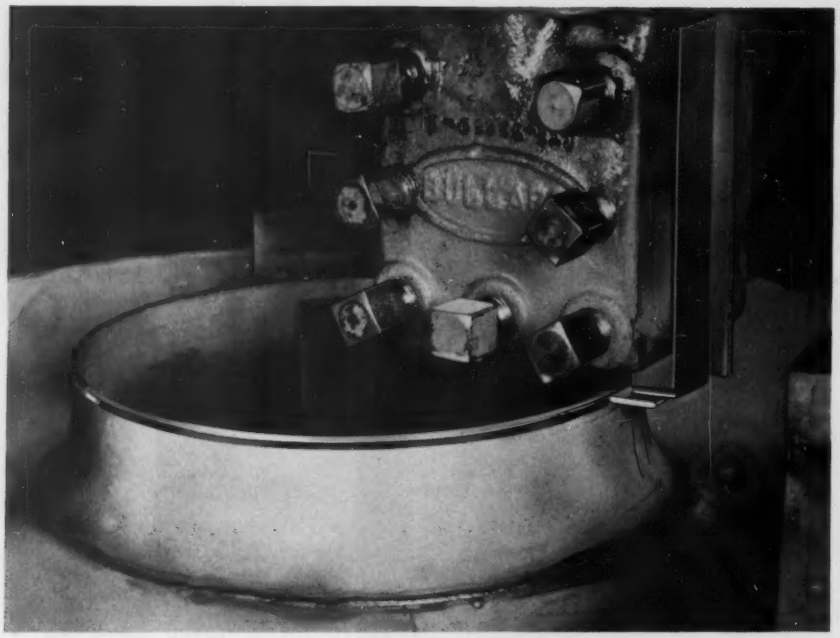


Fig. 5. An end-brazed tool is being used in a parting operation on a steel weldment. The strength of this type of tool construction enables it to stand up under high machining pressures.

increase the tool mass for strength and not to support the blank. Conventionally brazed tools often broke down during the operation. This required an excessive amount of polishing to smooth out the section of the work where the new tool picked up the cut.

A parting operation employing a carbide-tipped tool set up on a vertical boring mill may be seen in Fig. 5. The tool in this case is of the end-brazed type which easily withstands the high cutting pressures built up during the operation. A close-up view of the carbide tip is shown in Fig. 6.

Observation of the tool for the first time usually prompts a question as to how well the tip is held. The answer is that the braze, while only 0.002 inch thick, is sufficiently strong to hold the carbide blank. Furthermore, when the standard blank width serves as the blank height, a stronger carbide tool results.

A reduction in the inventory of carbide blanks may be realized with the adoption of the side- and end-brazed types of cutting tools. It is necessary to stock only one series of carbide blanks, the 1000 series. This reduces the inventory to 20 or 25 per cent of the various blanks normally required for top-brazed tools.

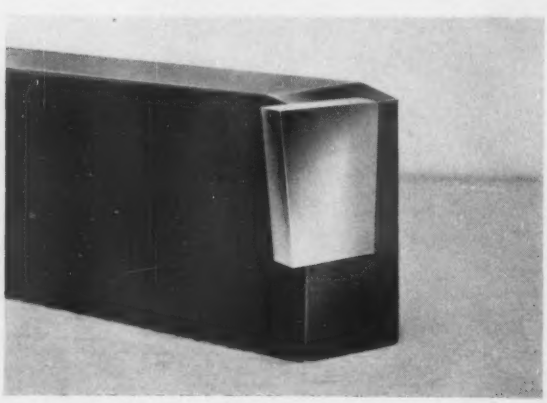


Fig. 6. Carbide blank is brazed to the end of this steel shank for use in the parting operation shown in Fig. 5.

* * *

From Millstone to Disc Grinding

The idea of using the side of a rotating circular stone or abrasive disc for grinding is probably as old as the art of grinding itself. The ancient millstone can be called the forerunner of today's abrasive disc wheels. Then, as now, abrasive discs made an important contribution to man's needs and welfare.

No longer confined to milling grain, the modern manufactured abrasive disc wheel is used, either singly or in multiple, in a wide range of applications from rough-surfacing to superfinishing; for processing non-metals as well as metals. With the advent of precision double-spindle disc grinding machines, production-minded industries recognized the advantages of producing two ground parallel surfaces simultaneously, and began to adapt these disc grinders to their needs. The automotive industry is probably the most outstanding example.—*Grits and Grinds*

Getting the Most Out of Your Diamond Wheels

By JOHN I. JENKINSON, Engineer
Bonded Products and Grain Division
The Carborundum Co.
Niagara Falls, N. Y.

THE close relationship between grinding wheel life and cutting effectiveness on the one hand, and correct truing and cleaning practice on the other, is axiomatic. When high cost enters the picture, as in the case of diamond wheels, the relationship becomes even more significant. This article attempts to assist the shop using diamond wheels by reviewing some proved truing and cleaning methods. Distinctions are drawn according to the type of bond—resin, metal, or vitrified—because of the widely different characteristics of each.

The broad term of "dressing" diamond wheels actually involves either one or both of the following: (1) truing the wheel face to its original or some desired shape; and (2) cleaning, or dressing, as it is usually called, the wheel face to remove glaze or matrix, thus exposing the diamond cutting points. The cleaning operation is less severe on the wheel, since it requires a smaller amount of bond removal.

Truing sometimes necessitates the removal of a considerable amount of the diamond matrix, with the loss of perfectly good diamonds. Excessive dressing—either through the use of a faulty procedure or the wrong abrasive—materially shortens wheel life. To conserve diamonds, the wheel face must be "open" so that the cutting action can be most effective. When the face becomes glazed or distorted, cleaning or truing is mandatory and should be undertaken with great care to retain the original shape.

Truing the Diamond Wheel

Straight (No. 1) type diamond wheels can be trued by three different methods. In the first, the wheel remains on the grinding machine spindle and runs at operating speed. Truing is performed by an abrasive wheel mounted on a toolpost grinder at an angle of 30 degrees to the machine spindle. This produces a scuffing or scrubbing of the diamond wheel face. For metal- or vitrified-bonded diamond wheels, a silicon-carbide vitrified dressing wheel, 100 grit, M grade, running at a maximum speed of 6000 surface feet per minute, is recommended. Stock removal from the diamond face should be very slow, about 0.0005 to 0.001 inch per minute. For resin-bonded diamond wheels, an aluminum-oxide vitrified dressing wheel, 100 grit, M grade, should be substituted. Surface speed remains the same.

The second truing method consists of supporting the diamond wheel between flanges on the work-centers of a cylindrical grinding machine. The abrasive dressing wheel is mounted on the spindle of the machine. With the diamond wheel rotating at 200 surface feet per minute, the table

Fig. 1. The diamond wheel, supported between centers, is trued by traversing the face of a silicon-carbide wheel mounted on the grinding machine spindle.

is traversed back and forth for the truing, as is shown on the Landis grinder in Fig. 1. The same dressing wheel designation and speed are recommended as before.

The third method employs a brake-controlled truing device. As in the first method, the diamond wheel remains on the grinding machine spindle and runs at operating speed; and the abrasive dressing wheel is presented at a 30-degree angle. Here again, recommendations are for a silicon-carbide vitrified dressing wheel, 100 grit, M grade, for metal- or vitrified-bonded diamond wheels; and for an aluminum-oxide vitrified dressing wheel, 100 grit, M grade, for resin-bonded diamond wheels.

Cup, dish, and other side-grinding types of diamond wheels—with resin, metal, or vitrified bonds—can be trued by machine grinding, using the same abrasive wheel recommendations as previously described, or by the method demonstrated in Fig. 2. In the illustration, a cup type metal-bonded wheel is being trued by hand-lapping on a cast-iron plate covered with loose abrasive grain. Lapping is performed with a figure-eight motion, the wheel being turned slightly after each motion is made.

Fig. 2. A cup-wheel is trued by hand-lapping in a figure-eight motion on a cast-iron plate which is covered with loose silicon-carbide grain.

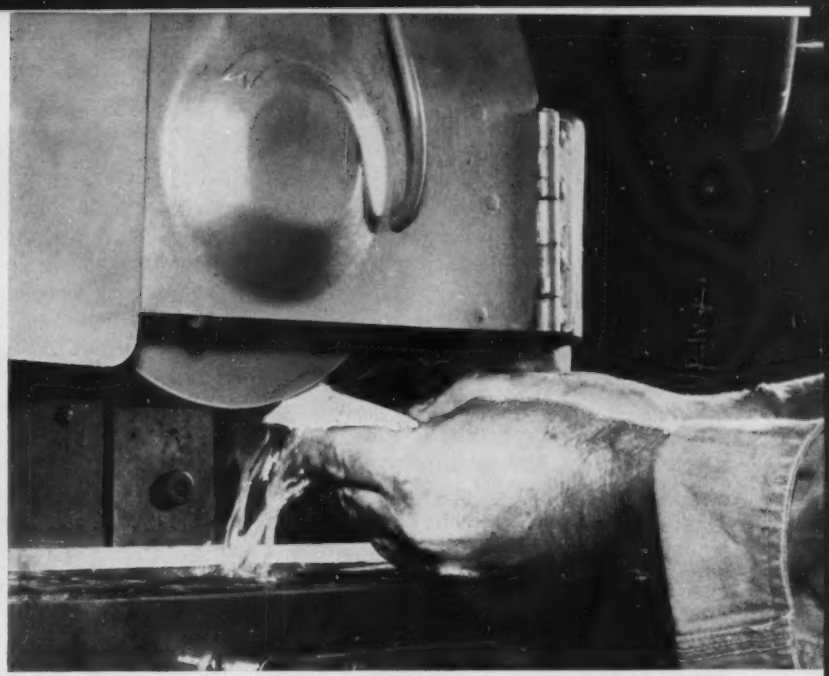


Fig. 3. An aluminum-oxide dressing stick removes glaze from the resin-bonded diamond wheel of the grinder. A light load can be removed with pumice.

For diamond wheels of 80 to 180 grit, a silicon-carbide abrasive grain, 60 to 100 grit, should be used; and for wheels of 220 to 320 grit, a silicon-carbide abrasive grain of 220 grit. An aluminum-oxide abrasive grain of 280 grit is recommended for lapping diamond wheels of 400 grit, or finer. Lapping can be done wet or dry. A glass plate can be substituted for the cast-iron one.

Cleaning the Diamond Wheel

Metal- or vitrified-bonded straight type wheels can be cleaned with a silicon-carbide vitrified dressing stick, 80 grit, M grade. The stick is applied manually to the face of the wheel while running at operating speed. Normally, contact for a minute or so removes glaze and load, and restores cutting efficiency.

A newer method of cleaning metal-bonded diamond wheels employs a wire brush. The brush must be rigidly mounted and must rotate at approximately 3600 R.P.M., with the diamond wheel running at the same speed. A lathe and toolpost grinder set-up is satisfactory, provided the diamond wheel, which is mounted on the lathe spindle, can attain the necessary speed. An

Fig. 4. An aluminum-oxide block is held on the magnetic chuck of a rotary table type grinder. Chuck rotates slowly and spindle at operating speed.

8-inch diameter brush having 0.016-inch wire is recommended. The advantage of this method is that the brush can scrub away the wheel matrix without dislodging the diamonds. This naturally results in much longer wheel life and consequent lower grinding costs.

Resin-bonded wheels are cleaned with an aluminum-oxide vitrified dressing stick, 120 grit, H grade. The manner of performing this operation on a wheel mounted on a Gallmeyer & Livingston surface grinder is shown in Fig. 3. If the wheel is only lightly loaded, it can be cleaned with a piece of pumice or an aluminum-oxide vitrified stick, 500 grit, F grade.

Similar methods are employed to clean the side-grinding diamond wheels. In the heading illustration, for example, the glaze on a fine grit resin-bonded wheel mounted on a Blanchard surface grinder is removed with an aluminum-oxide vitrified stick, 500 grit, F grade.

When heavily loaded or glazed, wheels on this machine can be cleaned as follows: A large ring type shellac-bonded silicon-carbide wheel, 320 grit, T grade, is cemented to a steel plate which, in turn, is positioned on the magnetic chuck of the machine. This chuck should be rotated at about 12 R.P.M. The spindle, not rotating, is lowered until the diamond wheel face just overlaps the wall thickness on the edge of the abrasive wheel. Since the abrasive wheel is powered, the diamond wheel will turn freely when contact has been made.

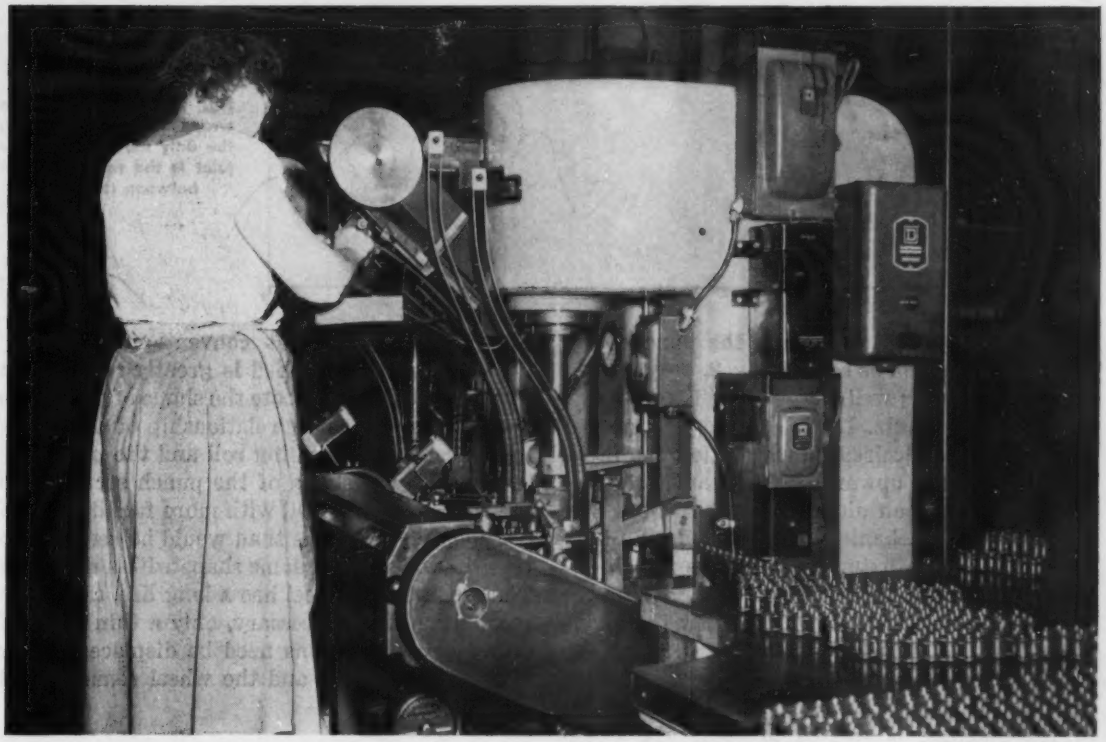
An alternate method, illustrated in Fig. 4, has an aluminum-oxide vitrified block, 500 grit, F grade, mounted on the magnetic chuck. The chuck rotates at about 12 R.P.M. and, in this instance, the spindle also is powered, running at operating speed. A very light down feed is used with a moderate flow of coolant.

Thin metal-bonded wheels, such as those used on cut-off machines, can be cleaned by a short pass through a material like sandstone, limestone, groggy type refractory brick, or cinder block, or through the stub of a discarded abrasive wheel. Care must be taken to avoid too long a contact, since these materials are highly abrasive and will reduce wheel life. With this method of cleaning, the wheel operates in the same manner as normally employed in production cutting.

The glaze can also be removed from this type of wheel and the diamond section sharpened with a silicon-carbide vitrified dressing stick, 80 grit, M grade. This stick is seen in Fig. 5 cleaning a diamond wheel on a Felker cut-off machine. The stick can be plunged directly into the periphery of wheels of less than 12 inches in diameter. For larger wheels, the stick should be applied to the two faces as well as to the periphery of the diamond rim.

Resin-bonded cut-off wheels can, in many instances, be satisfactorily cleaned with an aluminum-oxide vitrified dressing stick, 120 grit, H grade. If the load or glaze is light, plunging block or stick pumice into the wheel will do an effective job.

Fig. 5. A dressing stick is employed to clean the diamond wheel of this cut-off machine, while it runs at the normal operating speed.



Chain Manufacture Links Good Methods and Machines

By EDGAR ALTHOLZ, Associate Editor

ABOUT 65 percent of the total domestic output of automotive timing chain flows from the Ithaca, N. Y., plant of the Morse Chain Co., a Division of the Borg-Warner Corporation. The company also produces roller and silent chain, sprockets, couplings, and clutches for railroad equipment, construction machinery, Diesel engines, and turbines. Described here are some methods and machines in operation at the plant.

Manufacturing techniques for both silent chain and automotive timing chain are built around Morse's exclusive joint design, one variation of which is illustrated in Fig. 1. There are two hardened steel alloy pins in the joint—a rocker pin and a seat pin. These pins are so shaped in cross-section as to have no movement in their respective link plates; when the chain engages and wraps around the teeth of a sprocket, the only movement in the joint is the rocking action between the pins.

Each pitch of chain has its own link-plate dimensions, with pin-hole sizes to correspond. The punches and dies used to produce the holes in the link-plates have, of course, the same cross-section as the rocker pins and seat pins.

Punching and blanking of the link-plates from coiled stock are progressive operations, performed by batteries of Minster and V & O open-back inclinable presses. The presses are paired in tandem. Hitch feeds, automatic reel unwinders, and stock choppers provide a high production rate from each battery—as high as 800 link-plates per minute.

Because of their necessarily slender configuration, the punches have a relatively short life. This fact, coupled with heavy press schedules for a wide variety of chain pitch sizes, keeps the tool-room busy supplying punches. After being centerless-ground cylindrically, the punches are form-ground on a Brown & Sharpe No. 5 surface grinding machine to the required shape.

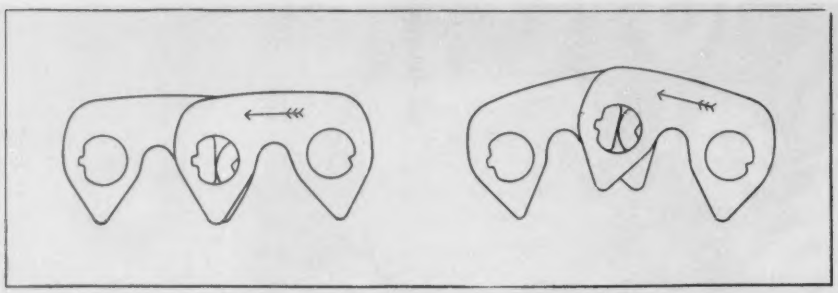


Fig. 1. When the chain wraps around the sprocket, the only movement in the joint is the rocking action between the pins.

Wheels used in form-grinding the punches are crush-trued, as can be seen in Fig. 2.

Crush-truing is well adapted to the company's punch requirements. In this practice, a master roll having the desired punch section cut in its periphery is fed upward under heavy pressure, or crushed, into an aluminum-oxide wheel. The roll, made of Meehanite, is supported by a ball-bearing trunnion fixture so that it is free to rotate. A low spindle speed is necessary during the crushing, provided for by routing the drive through a gear reduction unit.

When the reverse of the roll form has been produced in the periphery of the wheel, the table of the machine is shifted to bring the work-fixture into grinding position, as seen in Fig. 3. This fixture is set up on the table so that the axis of the punch is in line with the master roll. Only three roughing passes and one finishing pass are needed to complete the punch form in the work. The wheel operates at conventional grinding speeds, but the table feed is greatly reduced. In Fig. 4, drawings illustrate the shape of one of the punches, as well as the relationship of the grinding wheel to the dressing roll and the punch.

Crushing the shape of the punch section into the wheel is performed with more facility and in considerably less time than would be required to true the wheel to the same shape with a diamond. The crush-trued wheel has a long life, and when reconditioning is necessary, only a thin layer of dulled abrasive grains need be displaced. Stock is removed rapidly, and the wheel remains cool and free-cutting.

Heat-Treating the Parts

Elimination of the foundry, part of a current plant rehabilitation program, has enabled the company to rearrange and expand its facilities

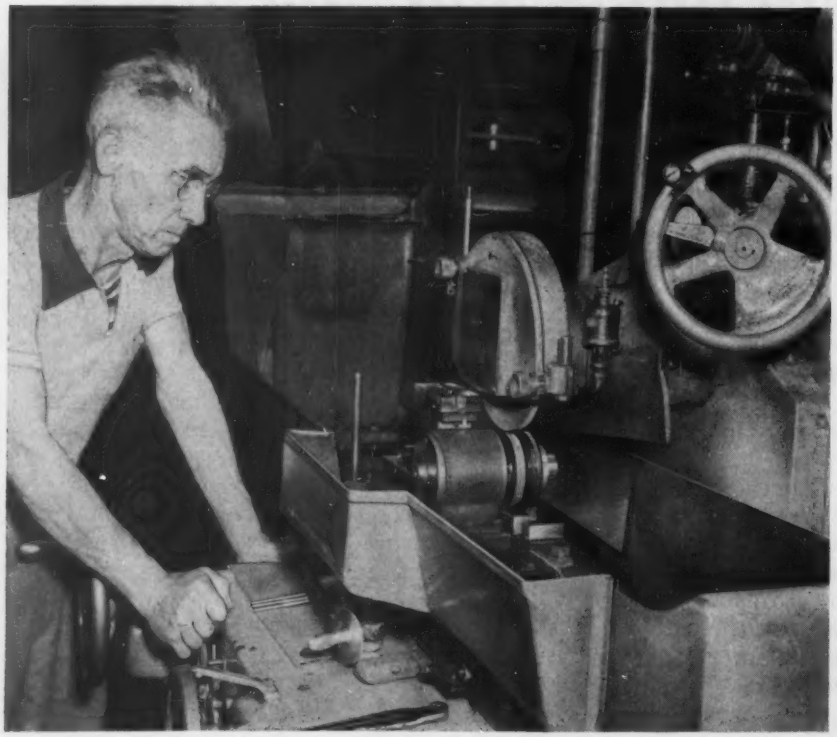


Fig. 2. The master roll is crushed into the periphery of the grinding wheel used to produce the punch section. The roll remains permanently in line with the work fixture on the grinder table.

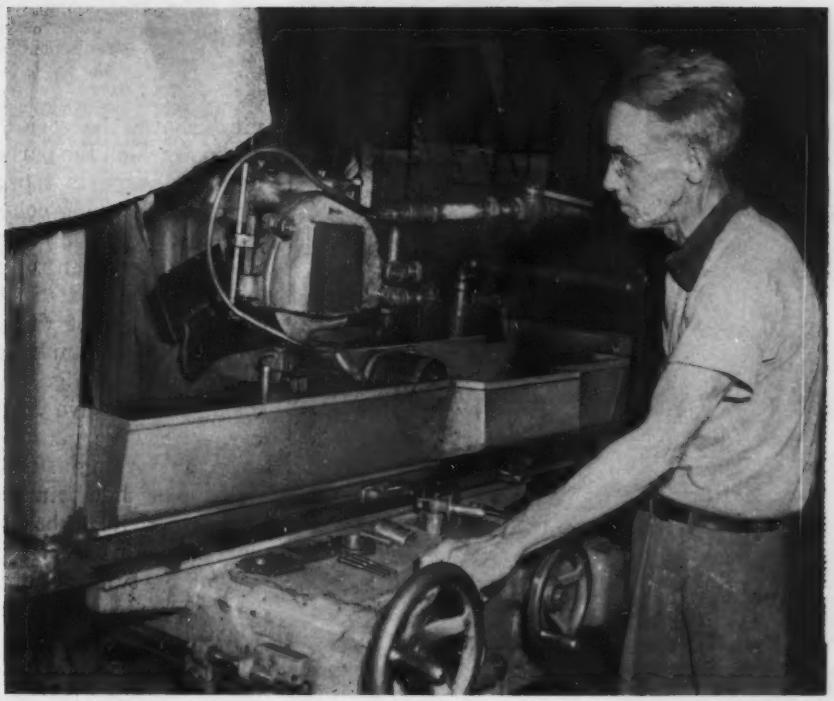


Fig. 3. After the reverse of desired shape has been crushed into the wheel, the table is shifted to bring the work-fixture into the grinding position.

for heat-treating. Two areas, instead of four, simplify the materials-handling problem, and permit a natural flow of work from preceding operations. In planning the new heat-treating departments, emphasis was placed on increasing the oil-quenching rate by strong agitation. Two Dow batch furnaces with propeller-circulated oil currents and new Surface Combustion continuous furnaces with high-volume quench oil circulating pumps make possible a close approach to the metallurgical goal of full hardening.

One of the newly installed rotary gas carburizing furnaces is illustrated in Fig. 5. The unit is shown tilted at the completion of a two-hour cycle for a 200-pound charge of link-plates.

During the cycle, the charge is rotated steadily, insuring complete mixing and uniform heating. The parts are discharged from the furnace into a quenching basket submerged in a sub-floor oil tank through which oil is pumped at a rate of 750 gallons per minute. To unload the basket, it is first raised by a cable hoist, as in Fig. 6. This

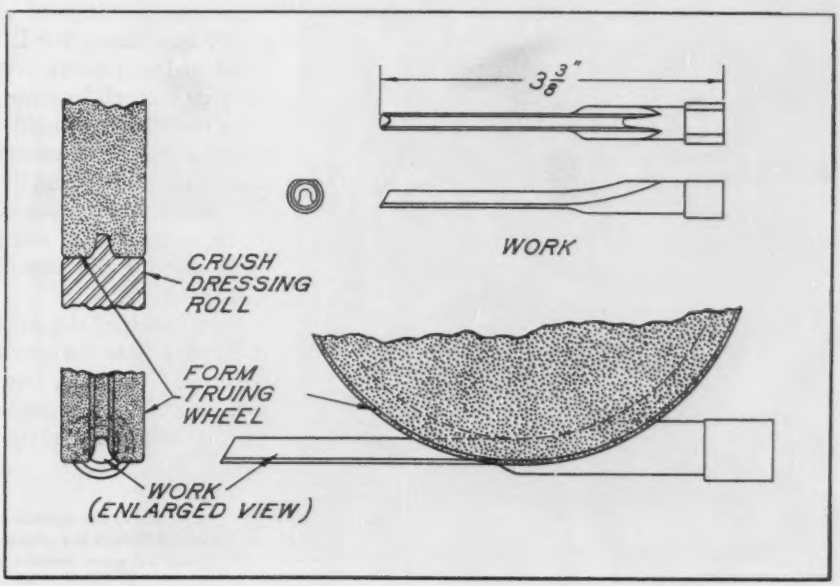


Fig. 4. The shape of the punch section is a reproduction of the section of the truing roll periphery.

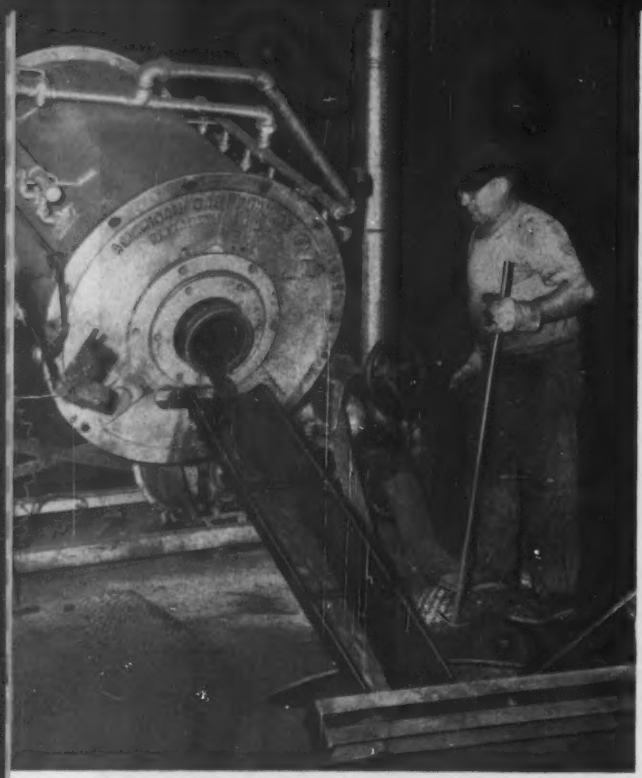


Fig. 5. The rotating furnace is tilted forward to discharge a batch of carburized link-plates into the sub-floor quenching basket.

view shows the series of cones of the basket through which the parts drop. The cones serve to agitate the parts thoroughly during their fall through the rising column of circulating oil. As the basket is elevated, a steel safety "doughnut" rises and floats on top of the tank.

One of the heat-treating operations is of interest because of the novel application of the company's own duplex chain. The equipment involved, seen in Fig. 7, is used for annealing the ends of automotive timing chain pins. Previously carburized, the pins must be annealed at their ends for riveting after the chains are assembled.

From a slide-actuated hopper, the pins drop through flexible tubes, assuming positions across duplex chains serving as conveyors running around the two sides of the mechanism. There are three tubes to each chain. The chains move intermittently, each time advancing a distance equal to three times their pitch. Gates at the discharge end of the tubes function in time with this movement, discharging a pin through each tube simultaneously into the chain.

Arranged along the line of travel of the pins are rows of gas jets, three on each side of the chains. The intermittent movement of the chains indexes the pins opposite the jets, with a dwell interval sufficient for the pins to reach annealing temperature. Subsequently, the pins are advanced, falling into chutes as the chains wrap around their forward sprockets.

Machines Now Assemble Chains

Today, assembly of chains is largely mechanized. Machinery for it is intricate and special, developed and constructed in the main by company personnel. In some instances, efficient units have been built around standard machine tools. Certain pitches of roller chain, for example, are assembled on Denison presses equipped with special loading mechanisms. In Fig. 8 is shown one of these machines, equipped with an indexing-dial table for the assembly of roller chain link-plate sections.

When each of the work-fixtures on the table is indexed to pass the operator's station, it is loaded with one link-plate, two bushings, and two rollers. At a station immediately ahead of the press ram, another link-plate is automatically thrust

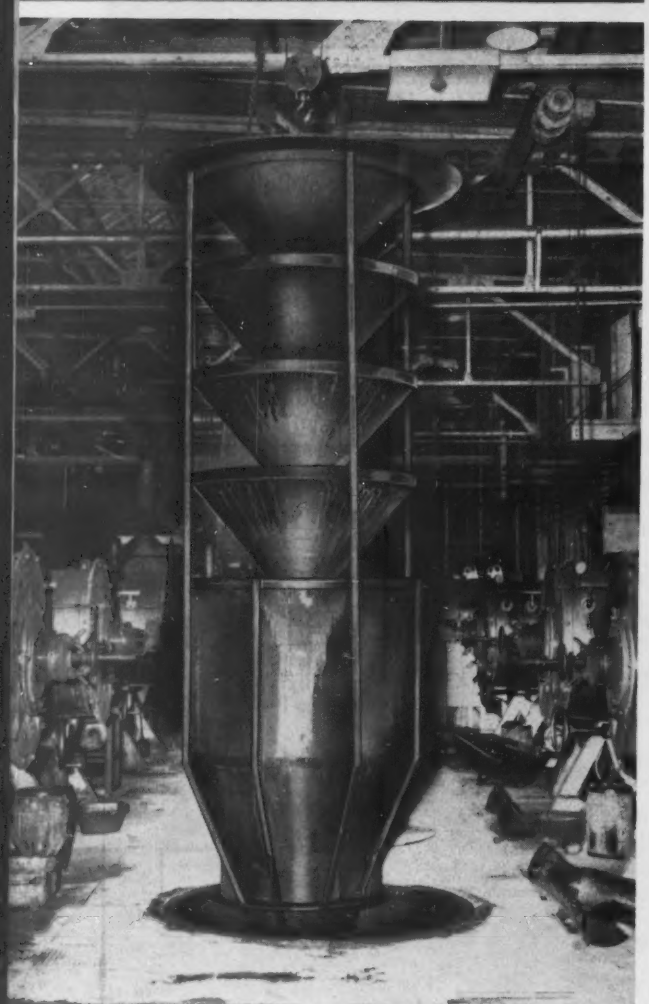


Fig. 6. Here, the quenching basket is elevated and drained before the charge is removed. Location of tanks between furnace rows saves floor space.

Fig. 7. The ends of automotive timing chain pins are annealed during the interval in which the pins are indexed opposite the gas jets.

forward from a stack, dropping over the bushings. In the subsequent index to the ram, the link-plates are pressed over the bushings.

For another pitch, two adjacent Denison presses, seen in the heading illustration, can assemble a roller chain of any required length. Pins, bushings, and rollers are automatically fed from hoppers and join roller and pin link-plates stacked on the presses to form the chain seen in the right-hand foreground of the illustration.

Both projecting ends of the pins in roller chain are spin-riveted simultaneously and automatically on company-designed machines, one of which is illustrated in Fig. 9. This particular view shows a 1 3/4-inch pitch chain in work. From a horizontal runway, the chain is engaged by a large sprocket which indexes and positions it so that each joint is aligned in turn between two opposing spinning heads.

A free-turning hardened concave roller is cross-pinned in the spindle of each head. Synchronized with the indexing of the sprocket, the spindles move in laterally against the pins, rotating in opposite directions in a cycle of several seconds. The spindles then retract and the sprocket indexes automatically, aligning the next pin.

A battery of ingenious assembly machines is a contributing factor in the company's high production of automotive timing chain. One of the machines is shown in Fig. 10. Rods positioned around an indexing dial hold alternate stacks of bushing link-plates and pin link-plates. A split hopper contains the pins and the bushings.

While indexing, a pin and a bushing dropping from the hopper are plunged into position over the periphery of the dial. At each station, the

Fig. 8. Equipped with an indexing dial, this conventional press has been converted to a semi-automatic assembly machine for link-plate sections.

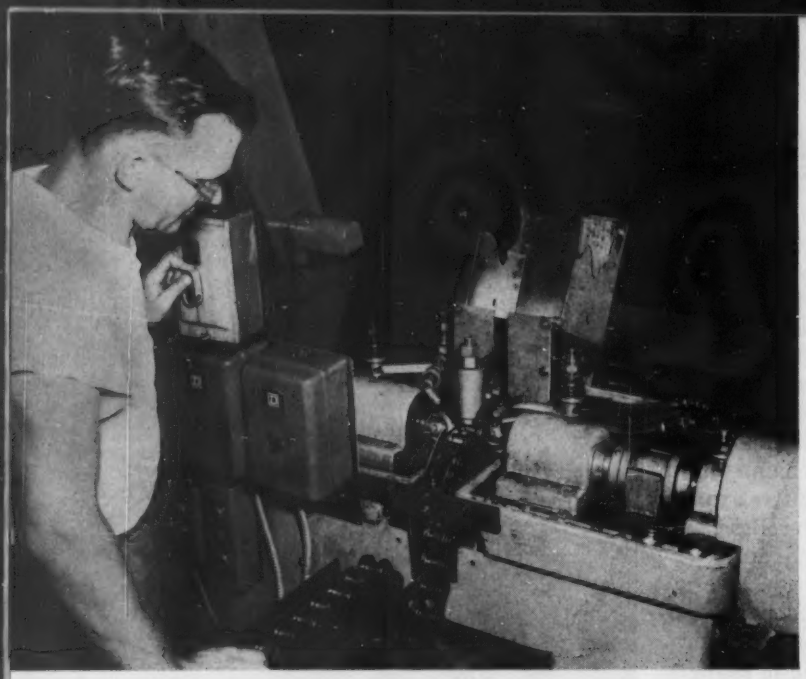


Fig. 9. The ends of the pins are riveted by concave rollers that spin simultaneously, but in opposite directions.

pins pick up their respective links, which are thrust by fingers into the dial periphery from the bottom of the stacks.

Each time the machine has assembled a finished chain length, an outer link-plate is automatically omitted. Later, a timing-mark link-plate is inserted here. A telltale light flashes when this joint has cycled through the machine, and the operator inserts a short, temporary pin. In this way, the chain can be wound in a continuous spiral, as seen on the table in the foreground. Subsequently, the chain is run in and roll-riveted on another special machine, then separated into required lengths.

In Fig. 11 is a view of one of the stackers. There are separate tumblers for the two kinds of links. Before traveling down the chutes, links are aligned in a common direction. A rejecting mechanism blocks the travel of any links inadvertently mixed in the wrong tumbler. One of the pairs of stacking rods can be seen extending backward from the bottom of the chute.

Assembled chains are subjected to a series of 100 per cent inspections, one of which is illus-

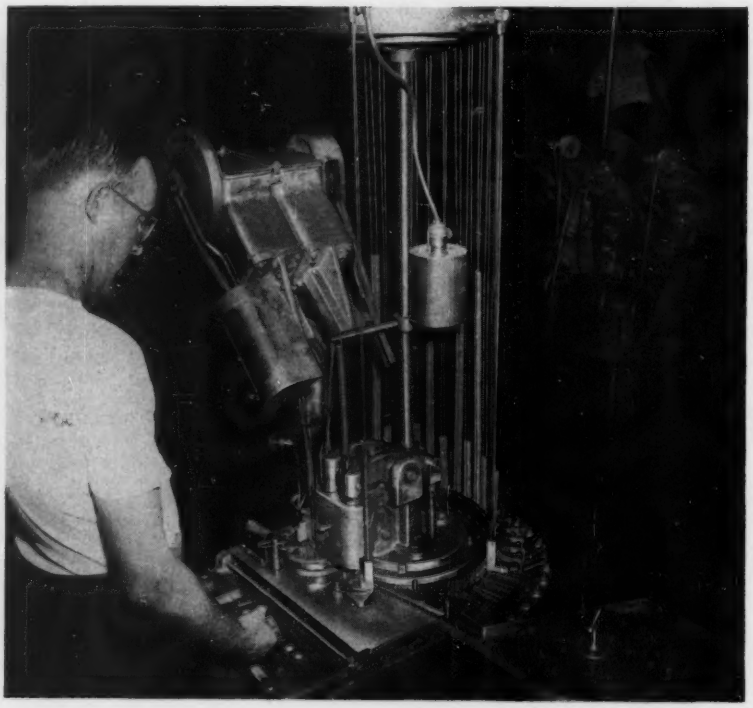


Fig. 10. Stacks of bushing link-plates and pin link-plates are positioned alternately and thrust on the dial at graduated levels to build up the chain to required thickness.

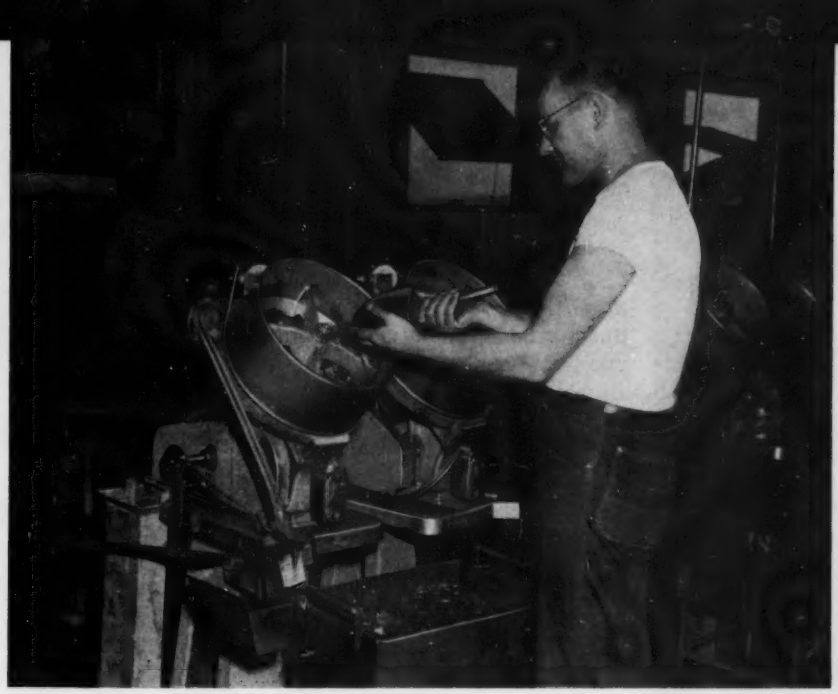


Fig. 11. Rods for automotive timing-chain assembly machines are here automatically stacked with link-plates from the tumblers.

trated in Fig. 12. Here, automotive timing chain is being carefully checked for length. In the machine used for the test, the chain runs around a pair of sprockets. One of the sprockets is mounted on a motor-driven spindle and the other, on a sliding carrier.

In inspecting the chain, the carrier is first moved toward the driving sprocket by means of a lever, so that the chain can be quickly positioned. Then, with the chain in motion, a thrust of the lever in the opposite direction places the chain under tension, at the same time backing the carrier against the anvil of a dial indicator. Initially set from a master chain, the indicator affords close control of chain length in an inspection cycle that is only a matter of several seconds. In a subsequent inspection, performed manually, the chains are flexed to uncover any excessive joint stiffness.

A metallurgical and chemical department carries on a full time research program at the Ithaca plant. In addition, this department creates and maintains standards for all purchased materials, standards for manufacturing, and standards for the operation and maintenance of all heat-treating equipment. A statistical quality control system is in effect for the in-process inspection of all chain components produced.

Fig. 12. In a rapid 100 per cent inspection cycle, chain lengths are checked while running and under tension by means of a dial indicator.

Fig. 13. The 1-inch pitch roller chain being inspected must meet a tensile specification of 14,500 pounds per square inch.

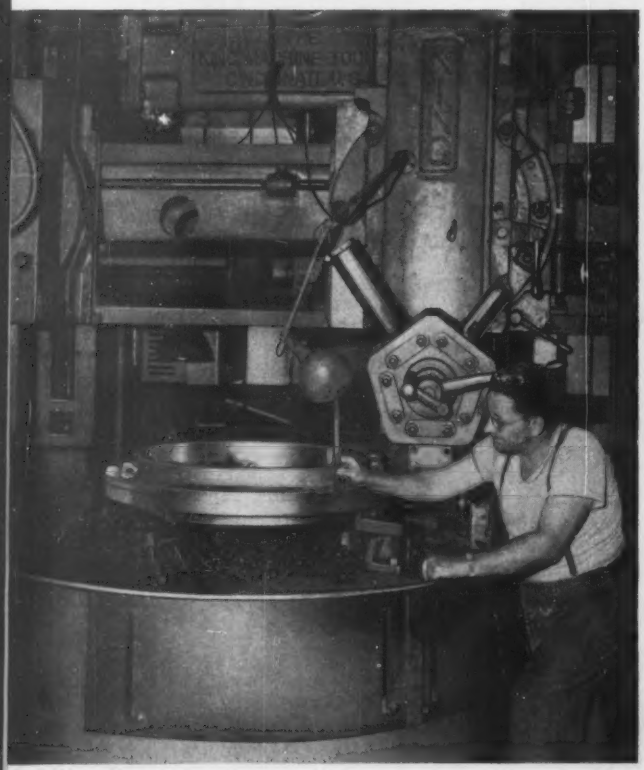
Steel is tested, identified, and assigned a stock number by means of which it is closely controlled during the manufacturing. Finished chain is inspected for adherence to the specifications of the Association of Roller and Silent Chain Manufacturers. In Fig. 13 is seen a routine tensile test being performed on a Riehle machine. Here, 1-inch pitch roller chain must meet the tensile specification of 14,500 pounds per square inch.

Sprocket manufacture is another Morse activity. Production of the smaller sprockets, together with that of clutches and flexible couplings, is concentrated at the Detroit plant and the larger sprockets at Ithaca.

In Fig. 14, the illustration shows an operator turning, facing, and boring a typical large sprocket which will be installed in a steam turbine. The sprocket is cast in steel in two half-sections. After the mating surfaces are faced, the sections are bolted together for machining. Later, the sections are separated for assembly over the turbine shaft.

The 28.750-inch inside diameter must be held to a tolerance of plus 0.001 inch, minus 0.000 inch, and face run-out to within 0.010 inch total indicator reading. Carbide tooling is used on the King 72-inch boring mill used for the operation. Cutting speed is in the range of 450 surface feet per minute. Later, 120 teeth for a 1-inch pitch roller chain are cut around the sprocket.

Fig. 14. For ease in assembly over a turbine shaft, the large sprocket seen on the boring mill is cast in two half-sections which are bolted together for the machining operations.



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Evaluating Apprentices

What does it cost to train apprentices? To what extent do they pay for their training by the work they perform during their apprenticeship? What is their potential value as journeymen after completing their training?

How to figure out the answers and determine the progress and ability of apprentices during their training are explained in a 24-page pamphlet entitled "Evaluating Apprentices," issued by the Bureau of Apprenticeship, U. S. Department of Labor, Washington 25, D. C.

* * *

Misnomer

The nickel silver family of alloys contains no silver whatsoever, but are alloys of copper, nickel, and zinc. They form tough, durable bases for plated flatware, such as knives, forks, and spoons.

Producing Rocket-Launching Tube Assemblies

By L. H. Cooper, General Manager
Aircraft Division, Rheem Mfg. Co.,
Downey, Calif.

ROCKET-LAUNCHING tube assemblies are now completely fabricated at the Aircraft Division of the Rheem Mfg. Co., in Downey, Calif. After accepting an ordnance contract, plant personnel went to work designing, installing, and tooling up a complete production line in record time.

Actually, the launching tube is an assembly of two tubes (forward and aft) and a collar. All are of stainless steel; the tubes originate as flat sheet and the collar as bar stock. For the forward tube, the sheet is sheared and blanked to size, then rounded on a press brake in three steps. The first step curls the edges to the tube radius, at the same time producing an inverted radius along the center, which gives the sheet the appearance of a shallow "W" in cross-section. In the second step, illustrated in Fig. 1, a cylindrical punch reverses the radius of the center, thus developing the tube shape. The third press-brake step closes the tube so that after its spring-back there is a 1/4-inch overlap of the seam for welding.

Tack-welding then follows on two company-designed machines called "poke" welders because of the manner in which the tube is positioned over a vertical arbor. On the first welder, three U-shaped extruded stainless-steel strips, known as lands, are tacked along the inside of the tube. These lands serve as guides in launching the missile. The heading illustration shows the arbor being prepared with one of the lands.

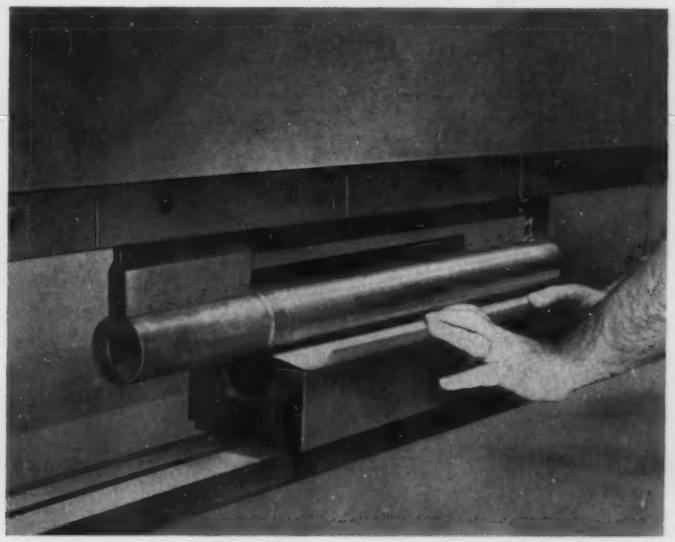


Fig. 1. In the second press-brake step, the punch reverses the center radius produced in the first step.

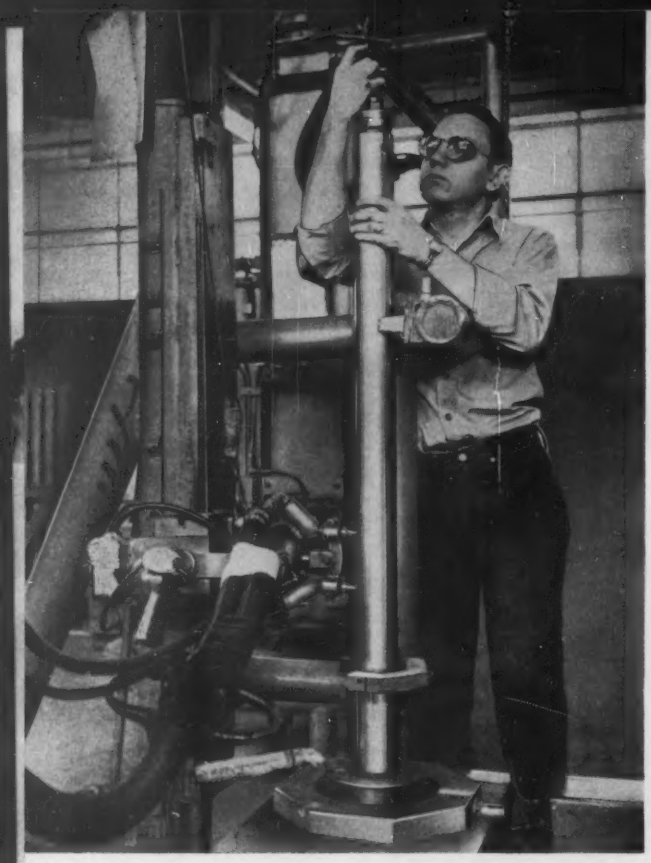


Fig. 2. The operator checks the clearance of the lands before tack-welding them to the inside of the tube.

Three pairs of parallel grooves, radially spaced 120 degrees apart, receive the legs of the lands in the copper body of the arbor.

The tube is slipped over the arbor and on a three-position indexing nest, and the lands are checked for clearance, as seen in Fig. 2. After clamping, a counterbalanced twin-headed gun on a vertical slide behind the arbor is lowered to contact the work. Standard spot-welding components are used to tack each of the lands in sequence. On the second poke welder, the seam of the tube is tacked.

Finish-welding of the lands and the seam is performed on a special Taylor-Winfield machine, Fig. 3. The work-fixture is moved under the direction of the welding wheel. A slope control permits the machine to produce a heavy weld.

Upon completion of the welding, the forward tube is sized in a hydraulic expanding apparatus, Fig. 4, which was developed at Rheem. The tube is positioned in a close-fitting, heavily reinforced cylinder. One section of the cylinder is enlarged so that the aft tube can also be accommodated. A neoprene bladder is inserted in the tube, the hatch (in the hands of the worker in the illustration) is attached and locked, and hydraulic fluid is pumped into the bladder at pressures up to 4500 pounds per square inch. In the process, the tube is expanded and work hardened at the same time.

Aft tube fabrication is similar except that the stainless-steel sheet used is annealed stock. Here again, the tube is formed in three press-brake steps, and then welded automatically in an inert-gas atmosphere. After the tube is expanded, the inside is burnished in a broaching operation, and holes are punched on the 125-ton Warco press seen in Fig. 5.

The stainless-steel collar is bored, chamfered,

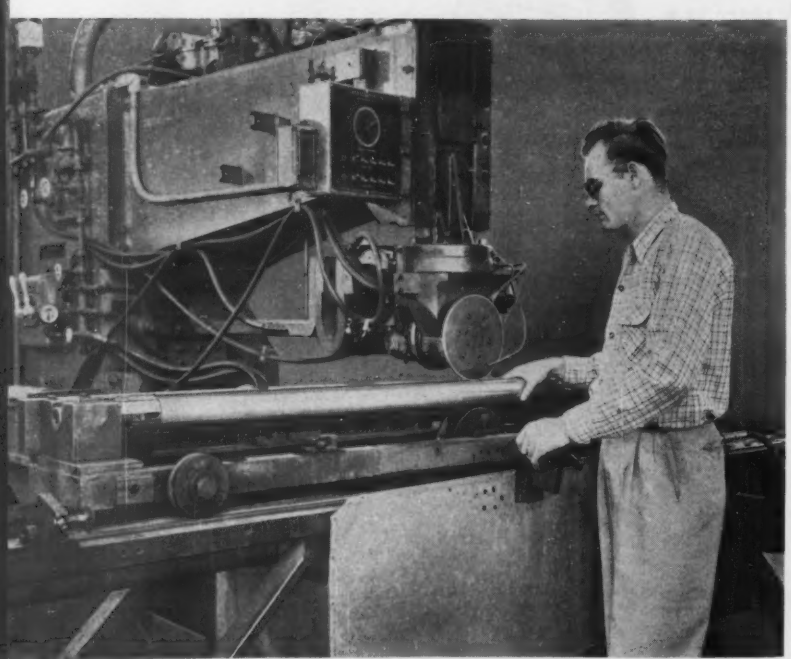


Fig. 3. Here the seam and the lands are roll-welded following the tacking operation.

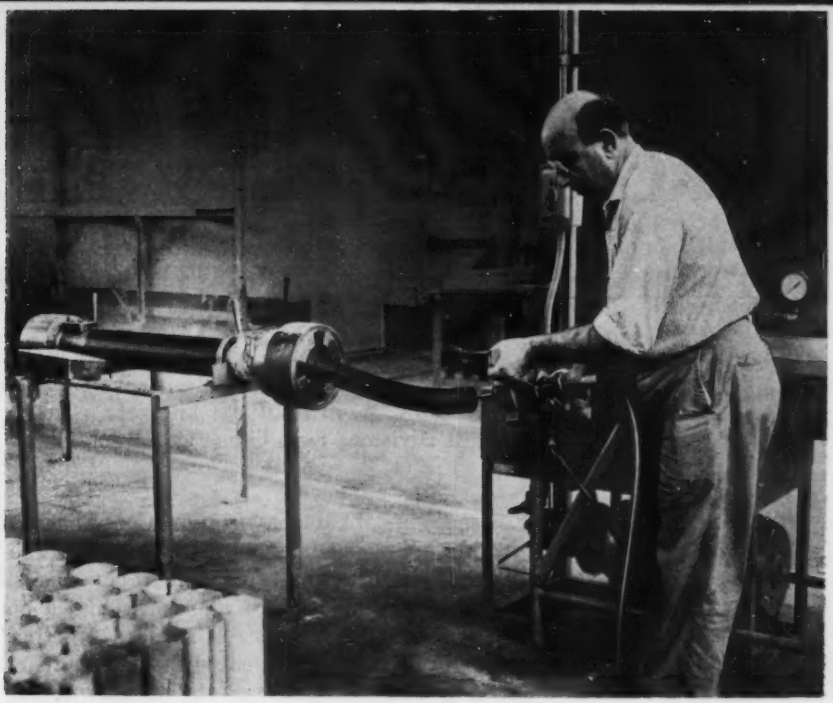


Fig. 4. Inserting the neoprene bladder preparatory to the expanding and work hardening of the tube

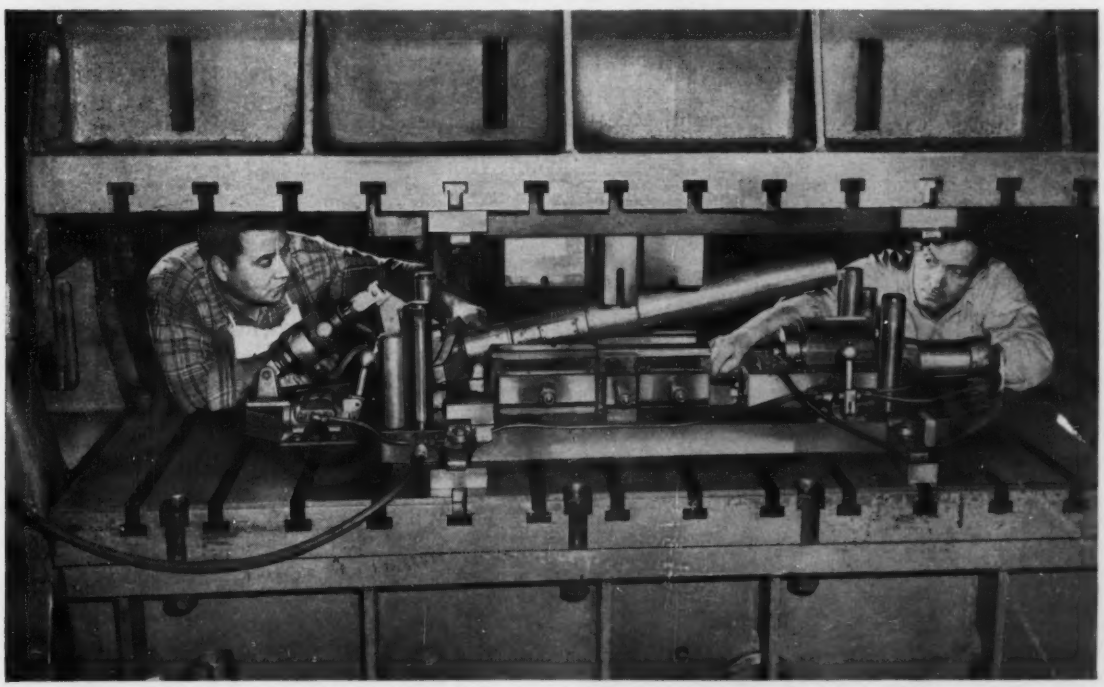
turned, and cut off from 3 1/2-inch bar stock on a Cleveland automatic screw machine. It is then grooved on a horizontal boring mill and internally thread-ground on an Ex-Cell-O machine.

In the assembly area, forward and aft tubes are pressed together hydraulically and spot-welded. The collar is then force-fitted on and welded. After a comprehensive final inspection, the exterior of the finished assembly is given a coat of non-glare paint.

Boom in Light Metal Manufacture

Nearly 22,000 companies in the United States now manufacture light metal products, compared with only 4000 ten years ago, according to an industry survey. Manufacturers, making everything from airplanes to zippers of aluminum, total 15,280. In addition, there are 4050 fabricators and 2619 die-casters and foundries producing light metal components.

Fig. 5. In a single set-up, a cam-action die punches a series of holes in the aft tube.



Low-Cost Method of Eliminating Wrinkles in Forming Aluminum

By R. MALTBY, Staff Assistant
and C. A. BLAIR, Plant Engineer
Aircraft Division, Twin Coach Co., Kent, Ohio

TO eliminate wrinkling of sheet-metal parts during rubber-pad forming on hydraulic presses, the Aircraft Division of Twin Coach Co., Kent, Ohio, employs draw clips to restrict the flow of metal during forming. Development of the draw clips was based on those described in the article "Forming Sheet Metal with Low-Cost Tools," published in March, 1952, MACHINERY, pages 186 through 191.

The draw clip consists of two flat sheets made of aluminum and a bottom plate of cold-rolled steel, secured together by screws. The center spacer is shaped to match the contour of the part to be drawn; the top sheet is cut to the

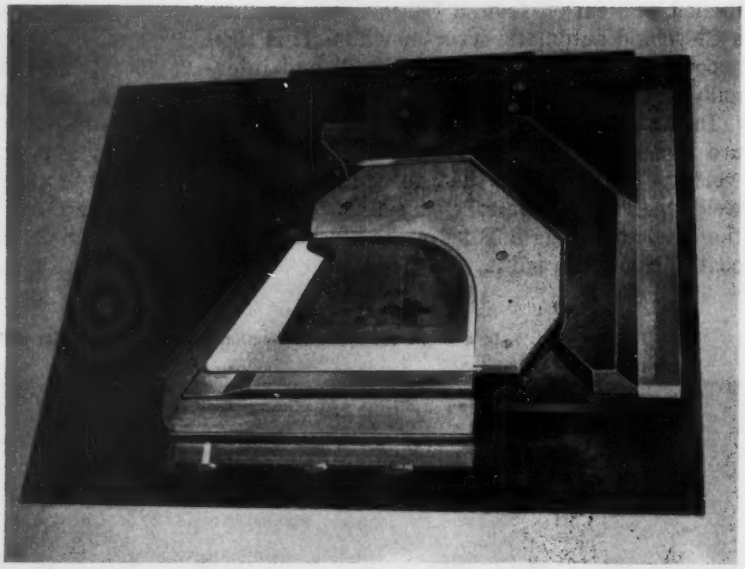


Fig. 1. Draw clip is slipped over edge of blank to prevent formation of wrinkles during rubber-pad forming operation.

Fig. 2. Confining block which backs up draw clip is shown at upper right, while clip is seen in operator's hand.

shape of the form block (with allowance for thickness of the metal to be formed); and the bottom plate exactly matches the outline of the form block. It is only necessary for the clips to enclose those portions of the blank where wrinkling would occur.

Parts made from 0.064-inch thick, 2024-O (24S-O) aluminum alloy are formed in this way at Twin Coach on a 500-ton hydraulic press. A form block is placed on the lower platen of the press, and the blank to be formed is placed in position on the block by means of locating pins. The draw clip is slipped over the edge of the blank, as seen in Fig. 1.

When the press ram descends, the rubber pad in the upper platen envelops the block and forms the blank to the required shape. The draw clip shrinks the excess metal, thereby preventing the formation of wrinkles, and becomes disengaged from the part at the completion of the forming operation.

Initial applications of the draw clip were made without a base or confining block. In such cases, wrinkles were completely eliminated, but the flange on the formed part would spring back and be approximately 15 degress from the required right-angle bend. When a base and confining block were added, they served to back up the draw clip and confine the rubber pad for added pressure. This effectively prevented opening up of the flange, while continuing the wrinkle-eliminating features.

A confining block is shown, out of position, at the upper right in Fig. 2, while the draw clip is seen being held in an operator's hand. Cost of this tooling is minor compared to the previous expense of hand-finishing that was required to remove wrinkles and correct the flange.

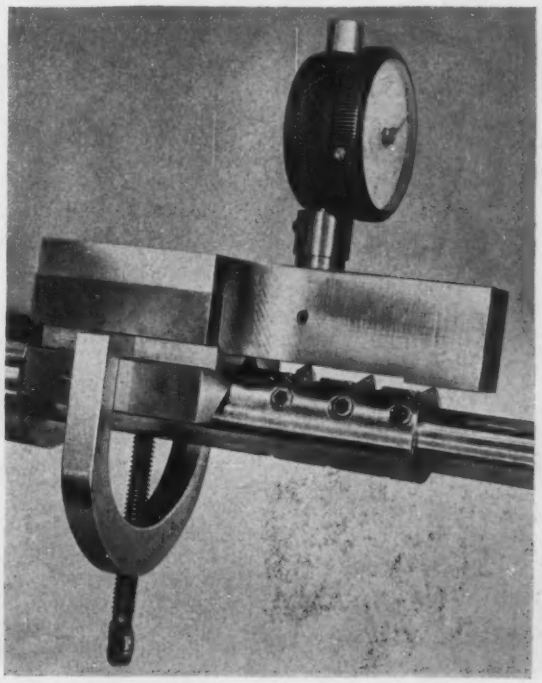
Boring Tool Gage Reduces Set-Up Time

Adjustment of boring tools at Temco Aircraft Corporation, Dallas, Tex., has been speeded up by means of the simple gage shown in the illustration. This gage permits the tools to be set to within 0.0001 inch of the desired position in a few minutes. It is constructed to adjust the tools to only one setting, and is used only in cases where the bore size is constant for a large volume of work.

Need for a gage of this type was noticed by operators of an Ex-Cell-O machine used to bore holes in a large number of castings. Although the boring cycle required only fourteen minutes, it sometimes took operators the same amount of time between cycles to check the adjustment of the three cutters on the boring-bar by means of micrometers.

The device now employed is a combination step and dial indicator gage, mounted on a small V-block. A clamp fits slots in the sides of the block, and holds the entire 4 1/2- by 1 3/4-inch device on the boring-bar. The stepped part of the gage overhangs the cutters when the gage is secured on the boring-bar. Each of the three steps on the gage is cut so that it marks the desired radius of sweep for its respective tool. Tools are adjusted by set-screws so that their tips touch the steps.

For the third tool—the one that makes the last, deepest, and most exacting cut—a 0.0005-inch Federal dial indicator gage is used to provide extreme accuracy. The indicator is mounted on top of the step gage and is actuated by a plunger which the tool tip touches when it is flush against its step. The gage is set so that it reads zero when the tool adjustment is correct within 0.0001 inch. Since this gage has been in use, hand-honing after boring has not been necessary, and set-up time has been reduced at least one-half hour a day.



Combination step and dial indicator gage reduces set-up time in adjusting three tools on boring-bar. Dial indicator permits setting third tool to within 0.0001 inch.

Huge Band-Sawing Machine Features Remote Control

GIANT band-sawing and filing machines, believed to be the world's largest, are in operation at Alcoa's aluminum extrusion plant, Lafayette, Ind., for cutting intricate openings in extrusion dies weighing up to 10 tons, stretcher jaws, and aluminum ingots. The dies are employed in extrusion presses ranging up to 14,000 tons in capacity, while the jaws are used on a 3,000,000-pound stretching machine. The high-strength extruded aluminum shapes, from 30 to 110 feet in length and up to 34 inches in width, make possible the economical construction of guided missiles and supersonic planes.

The DoAll band-sawing machine, Fig. 1, stands 15 feet 10 inches high, weighs 16,000 pounds, and occupies a floor space of 21 by 17 feet. It employs 40-foot saw bands to slice through steel die-blocks up to 26 inches thick and 52 inches in diameter. Three tables, stacked vertically one on top of the other, are provided to hold and manipulate the heavy work-pieces.

Movement of the work into the saw and operation of the machine are accomplished electrically and hydraulically, and are controlled by the operator from a station suspended from the head of the machine and located over the machining area. The operator is seated in the control station, as seen in Fig. 2, and has a close-up view of the cutting action through a viewer that uses a periscope-like arrangement of mirrors. The height of the station can be adjusted electrically over a 28-inch range, and the station can be rotated manually through 90 degrees and swung out over the working area.

Fig. 1. This giant band-sawing machine standing almost 16 feet high can handle pieces up to 26 inches thick by 52 inches in diameter.

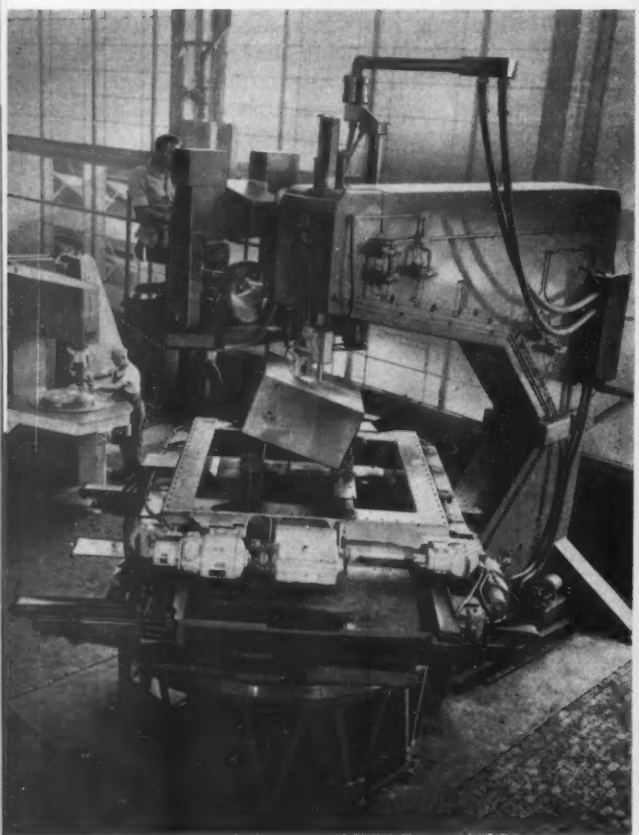


Fig. 2. Remote operation is performed from an elevated control station over machining area. View of cutting action is obtained through "periscope."

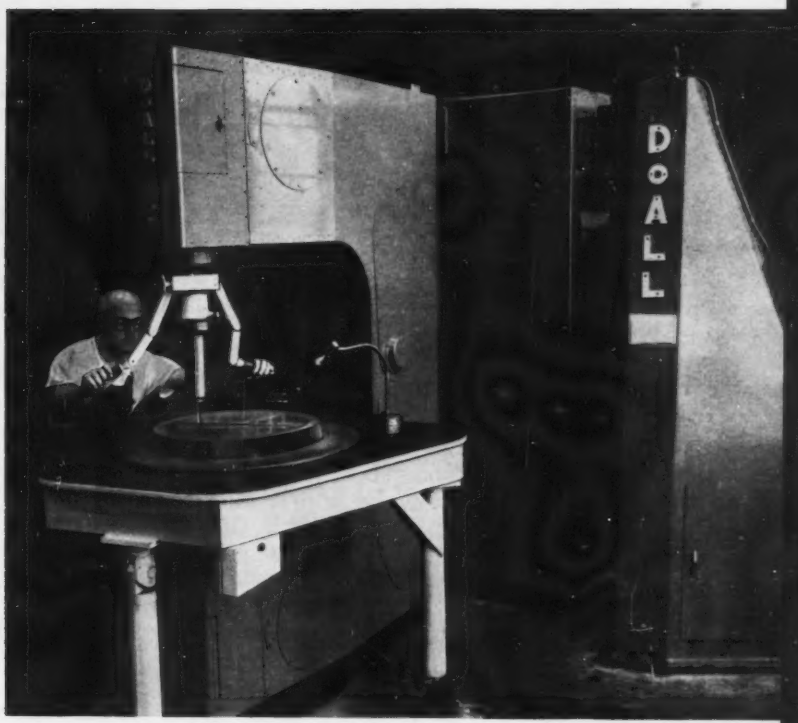


Fig. 3. On this machine, the work is stationary on the table and the file is directed against the work by moving lightweight hinged frames.

The operator guides the work into the saw, along any curved or straight lay-out line, by means of a steering-wheel control. This control is connected with an electronic brain that automatically coordinates the movements of the three individually motor-driven tables. To move the work into the saw blade, the operator pushes the wheel forward; to retract the work, he pulls the wheel toward him. By turning the wheel to right or left, the work is automatically rotated in the same direction.

An indicating control system using strain gages is provided to keep the operator informed of the pressure between the work and the saw band. This pressure is maintained at the value set by the operator, and automatic safety checks will stop all table motion before the cutting and feeding forces become excessive. Controls are also provided for adjusting and maintaining saw-band tension, adjusting upper saw guide position, shifting saw speed ranges, varying saw speed within a range, and tilting the three saw-band carrier wheels to "track" the saw band.

Saw-band speeds can be varied from 50 to 2000 feet per minute. Sharp radii from 1/16 inch upward can be cut because bands as narrow as 3/32 inch can be used. The maximum band width is 1 1/2 inches. An air jet removes chips from the lay-out line on top of the work-piece, and a recirculating coolant system is provided. The combination work-table feeding speed and rotary motion through 360 degrees are infinitely variable from 1/16 inch to 32 inches per minute and 0 to 3/4 R.P.M. by electronic controls.

The band can rapidly contour-saw directly to a lay-out line. Unwanted material can be removed in sections. Male and female jaws for the stretching machines can be shaped simultaneously from one piece of steel in one operation. Sections removed from the die-blocks in band sawing are salvaged for other jobs.

After the extrusion dies have been machined on the band saw, the die aperture is finished on the DoAll filing machine seen in Fig. 3. This large machine has a throat capacity of 38 inches and a capacity for filing work 19 inches thick over a 30-inch diameter working area.

A unique feature of this machine is that the die is not directed against the file, but remains stationary on the work-table. Instead, the file is directed against the die by moving the filing head frame and intermediate frame while rotating the file to the proper angle. By using a hinged construction for the head and intermediate frames (with anti-friction bearings used for the hinges), and an aluminum box type construction, the jig filing head can be swung with negligible effort in finishing the die apertures.

Infinitely variable filing strokes from 50 to 350 strokes per minute are available. A variety of file shapes from 9 to 23 inches in length can be used, with a filing stroke from 0 to 9 inches. Incorporated with the jig filer is a separate work-table that can be tilted 5 degrees in any direction.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

High-Temperature Alloys for Jet-Engine Applications

Vacuum melted high-temperature special alloys for turbine wheel buckets of jet engines and other applications are now being produced on a commercial basis by the General Electric Co., Detroit 32, Mich. Initial output will be from a pilot plant comprising a 400-pound vacuum melting furnace capable of producing 100,000 pounds of high-temperature alloys annually.

The new facilities, which are now located in Schenectady, N. Y., will place the Carboloy Department in a position to do job-shop vacuum melting of specialty alloys for bearings and springs, of magnetic alloys, of metals for atomic energy applications, and of high-purity, gas-free metals for electronic applications.

Alkaline Type Etchant Provides Controlled Etch on Aluminum

A granular alkaline type aluminum etchant which provides a rapid, uniform controlled etch on aluminum, and eliminates the troublesome problem of hard sludge build-up on equipment surfaces has been announced by Oakite Products, Inc., 126 Rector St., New York 6, N. Y. Oakite Composition No. 160, as it is called, is readily soluble in water to form working solutions having long life. Either hot or cold water can be used in rinsing. No troublesome fumes are given off. The sludge created during etching operations with this material is no more than a soft slurry, which may be flushed down the drain when the solution is discarded.

Aluminum "Metal" Shell Provides Protection Against Corrosion

The protection of iron, steel, aluminum, and wood surfaces is facilitated by the use of an anti-rust coating that forms a shell of non-porous aluminum "metal." Duro Aluminum Shell Coating, as it is known, is composed of atomized aluminum (in the form of shot) that is bonded on the surface with a fluxing vehicle. It dries dust-free in less than one hour, and to an extreme metallic hardness in six hours. When dry, it can actually be filed. The coating will withstand considerable flexing, as well as extreme hot and cold temperatures.

In addition to protecting structural work, it is useful for coating porous castings, metal signs, and automobile bodies. When applied on wood, it serves to guard against warping, checking, and cracking. This product has been announced by the Industrial Division of the Woodhill Chemical Co., 1391 E. 33rd St., Cleveland 14, Ohio.

Steel Plates in Warehouse Cut Inventory Needs

A selection of heavy steel plates ranging from 200 by 100 inches by 1/2 inch thick to 140 by 80 inches by 15 inches thick, with tensile strengths ranging from 55,000 to 85,000 pounds per square inch, has been made available by the By-Products Steel Co., a Division of Lukens Steel Co., 702 Strode Ave., Coatesville, Pa., from its warehouse stock. Fabricators using heavy plates may thus eliminate the need of carrying a large inventory. Furthermore, users can benefit by having the plate flame-cut to exact size and shape—and paying only for the freight on that portion of the plate that they actually use.

Materials Developed for Stainless-Steel Submerged-Arc Welding

The production of sound welds on stainless and alloy steels by submerged-arc welding, using a type of flux known as Arcosite Flux in conjunction with a stainless-steel wire called "Chromar," has been announced by the Arcos Corporation, 1500 S. 50th St., Philadelphia 43, Pa. The flux is suitable for welding chromium-nickel (austenitic), straight chromium (ferritic), and chromium-molybdenum (martensitic) stainless steels.

The particle size of the flux is carefully controlled to assure uniformity of arc action, alloy recovery, bead penetration and shape, and easy flow through flux-feeding devices. "Chromar" stainless-steel wire is available in seventeen different compositions in level-layer wound spools,

coils, and straightened and cut bundles. It may be used with the inert-gas and oxy-acetylene or atomic hydrogen methods, as well as with the submerged-arc method.

Beryllium Copper Strip that will Require No Heat-Treatment

A new type of mill-hardened or pre-tempered beryllium copper, called Penntemp, which offers many of the features of regular age-hardening beryllium copper yet requires no heat-treatment, has been announced by Penn Precision Products, Inc., 501 Crescent Ave., Reading, Pa. It offers high strength, hardness, good fatigue resistance, conductivity, and corrosion resistance. The material is available in five tempers in thicknesses from 0.001 to 0.025 inch with minimum tolerances ranging from plus and minus 0.0001 inch to plus and minus 0.0004 inch, depending upon thickness, and in widths from 1/8 inch to 5 inches, with tolerances of plus and minus 0.001 inch or plus and minus 0.002 inch, depending upon the width.

Weldable Aluminum Alloy for Structural Uses

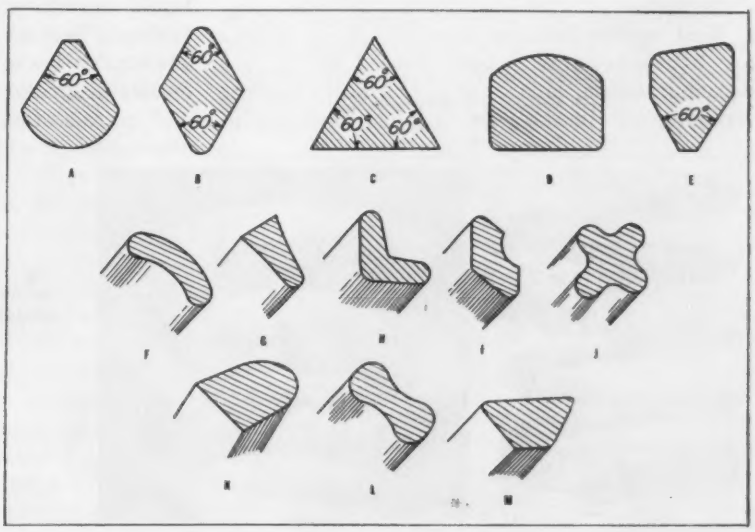
A high-strength aluminum alloy, designed especially for weldability and adaptability to structural applications, has been announced by the Kaiser Aluminum & Chemical Corporation, 1924 Broadway, Oakland 12, Calif. The alloy has been designated K186, and cannot be heat-treated. It is available in sheet and plate form, in a full range of four tempers, for such uses as unfired pressure vessels, structural towers, trusses and girders, and scaffolding.

The nominal composition of K186 is 4.0 per cent magnesium, 0.45 per cent manganese, 0.10 per cent chromium, and the balance, aluminum. Tensile strengths of this alloy range from 38,000 to 47,000 pounds per square inch, yield strengths from 17,000 to 37,000 pounds per square inch, and elongations in 2 inches from 22 to 10 per cent, all depending upon the temper. It exhibits good forming characteristics, especially when heated to 400 degrees F. The alloy is corrosion-resistant. Results of tests made on transverse welded specimens showed that, with beads, the ultimate strength was 39,900 pounds per square inch; and, with beads machined flush, 35,500 pounds per square inch, as compared to a longitudinal tensile strength of 44,700 pounds per square inch of the parent metal. Standard finishing procedures can be followed and corrosion-resistant anodized finishes can be applied.

Wire of Intricate and Unusual Cross-Section Available

Wire in various cross-sections, and in several materials, has recently been announced as a service of the Heli-Coil Corporation, Danbury, Conn. This formed wire is available in sizes ranging from a maximum cross-section of 3/16-inch diameter down to a minimum of 0.015-inch diameter. Tolerances can be held to 0.0002 inch and surface finishes from 8 to 15 micro-inches can be produced. Hardnesses up to 50 on the Rockwell C scale can be obtained by work hardening.

The concern presently produces wire thread inserts in diamond cross-sections formed of stainless steel and phosphor-bronze for the protection of threads in soft materials such as plastics, wood, aluminum, and magnesium, as well as iron and steel (cross-section B in illustration).



Some cross-sections of wire made available in a variety of materials, one or two of which have been used to make wire thread inserts

Liquid Abrasive Blasting of Springs

By H. J. STEEL

Fatigue life of springs can be improved by blasting with fine abrasive suspended in water. Inside surfaces of closely coiled springs can be reached, and surface defects can be removed rather than closed over

DURING recent years, there have been rapid developments in the techniques and variety of applications of liquid abrasive blasting. In this method, fine abrasive particles suspended in a fluid carrier are blasted against the work surface by compressed air.

Liquid abrasive blasting has been successfully applied in removing tool marks and burrs from machined surfaces, cleaning die-casting dies, and preparing surfaces that are to be chromium-plated. In addition to removing metal, oxide or chemical layers, carbon deposits, and other forms of contamination from the surfaces of work-pieces, this method has a cold-working effect similar to that obtained with shot-peening.

The ability of liquid abrasive blasting to produce a high surface finish of such a character as to insure good fatigue resistance, and at the same time to induce residual compressive stresses in the surface layers, has made the method suitable for the final treatment of heavy-duty springs that are required to operate under exacting conditions. The process is effective in removing certain defects which might give rise to fatigue failure in service. It also accentuates rather than conceals more serious defects that cannot be removed, so that they are readily detected by visual inspection.

Most spring failures encountered in service are attributable to fatigue caused by surface decarburization, laps, seams, and other surface irregularities in the wire. Typical examples of discontinuous and continuous seams are shown in Fig. 1. Frequently, the harmful effect of such defects can be minimized, and the failure prevented, by shot-peening the springs. However, in some instances, the springs are either too closely coiled to allow the shot to penetrate to the inside surface, or contain defects which are merely closed over and masked by peening.

Grades of Fused Alumina Abrasive

Mesh or Grit Number	Mean Particle Size, Microns (1 Micron = 0.001 mm.)
60	250
80	177
100	125
120	105
150	88
180	74
240	53
320	31
400	22
600	9.3
850	6.6
1200	4.7

As a result, an investigation was undertaken by Joseph Lucas (Gas Turbine) Equipment, Ltd., in England, to determine the suitability of liquid abrasive blasting for the treatment of springs. This article is primarily concerned with the application of the process to the treatment of small coil springs made from hard-drawn wire.

A cross-sectional view of the cabinet employed

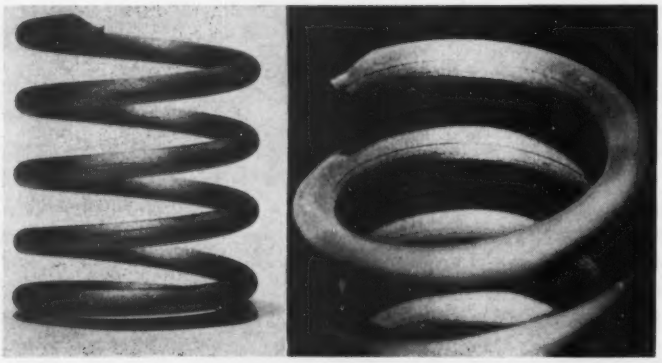


Fig. 1. Typical macroscopic defects in springs. (Left) Discontinuous seam revealed by etching in 50 per cent boiling hydrochloric acid, and (right) continuous seam on inside of a spring.

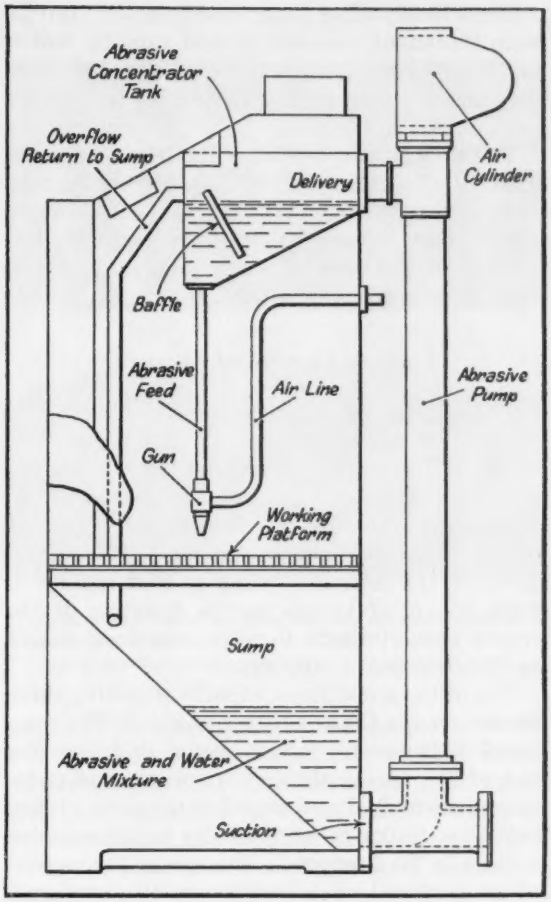


Fig. 2. Cross-sectional view of cabinet employed for liquid abrasive blasting. Abrasive and water are raised from sump by air pump.

for liquid abrasive blasting is shown in Fig. 2. A mixture of abrasive and water, charged into the sump, is raised by means of an air-operated, ram type pump to a concentrator tank located in the top of the cabinet, in which the concentration of abrasive in water is raised to approximately 50 per cent by volume. This mixture is then fed by gravity to the nozzle, where it is ejected onto the work at high velocity by means of compressed air under a pressure of 80 to 100 pounds per square inch. The nozzle, Fig. 3, is designed in such a manner that the abrasive-water mixture flowing down the central tube is accelerated by the air blast just as it leaves the tip of the nozzle, so that abrasion of the nozzle itself is avoided.

The abrasive employed was fused crystalline alumina (Al_2O_3). This material was selected in preference to silicon carbide, because of its greater toughness and consequent resistance to breakdown. The cutting properties of aluminum oxide are, however, slightly inferior to those of silicon carbide. Any grain size varying from 1 to 250 microns mean particle size is suitable for use with the blasting cabinet. Typical mesh numbers and mean particle sizes are given in the accompanying table.

For all the tests described in the article, the sump of the blast cabinet was charged with 10 gallons of water, and 25 pounds of abrasive, giving a ratio of 4 to 1 by weight. The water-abrasive discharge ratio at the nozzle, when using 80 to 150 grit abrasive for treating springs, was approximately 1 to 1.

The helical compression springs used as test specimens had a free length of 2.32 inches, twenty-four complete coils, and an outside diameter of 0.370 inch; and were made from a single length of 0.048 inch diameter, cold-drawn wire. The chemical composition of this material falls within the range of 0.75 to 0.85 per cent carbon and 0.5 to 0.7 per cent manganese. This particular design of spring was chosen because, owing to severe operating conditions in service, it was susceptible to fatigue failure, and was difficult to shot-peen due to close inter-coil spacing.

After stress-relieving at 300 degrees C. for thirty minutes, specimens from uncoiled springs gave an ultimate tensile strength of 254,000 pounds per square inch. Hot-etching in 50 per cent boiling hydrochloric acid showed the wire to be free from gross drawing defects and areas of high local stress. The surface finish of the wire revealed by microscopic examination showed numerous angular surface irregularities having a maximum depth of approximately 0.0005 inch.

The essential requirements of uniform metal removal and peening were obtained by axial rotation and longitudinal oscillation of the springs under the blast stream, as shown diagrammatically in Fig. 4. In order to maintain a round wire section, it was found necessary to set the abrasive nozzle at an angle to the spring axis. This angle, and the distance of the nozzle from the spring, appeared to be critical, and values of 45 degrees and 2 1/2 inches, respectively, were found to give the best results.

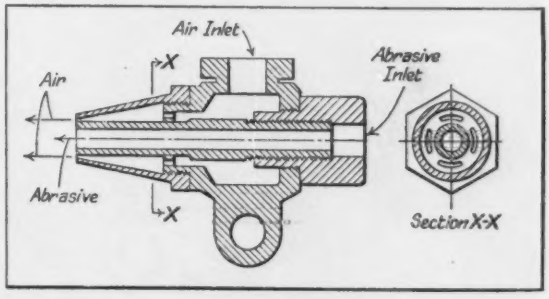


Fig. 3. In blasting nozzle, abrasive-water mixture flowing down central tube is accelerated by compressed air just as it leaves tip of nozzle.

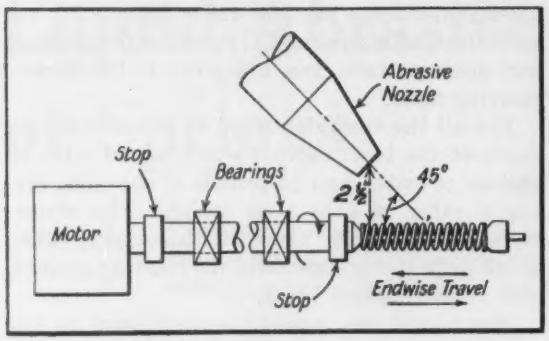


Fig. 4. Set-up used for axial rotation and longitudinal oscillation of springs to insure uniform metal removal and peening during blasting.

To obtain uniform coverage of the whole surface of the spring, it was necessary to reverse the position of the spring on the jig, and insure an equal time of exposure to the blast in both positions. The time of exposure was determined by the amount of material to be removed in order to eliminate surface defects.

A summary of the operating conditions which, with the exception of the grades of abrasives, were maintained constant throughout the tests, are given below:

Air pressure, 80 pounds per square inch;
Spring rotation speed, 600 R.P.M.;
Longitudinal oscillation, 2 inches per second (approximately);
Nozzle to spring distance, 2 1/2 inches (vertical distance);
Nozzle angle, 45 degrees;
Exposure to blast, two minutes;
Material removed, 0.001 inch from wire diameter;
Particle sizes of abrasive tested, 125 and 177 microns.

Immediately after vapor blasting, the springs were thoroughly washed in cold running water to remove adherent particles of abrasive, and then immersed in a de-watering oil to prevent rusting.

The method employed for the liquid abrasive blasting of springs described is, of course, only suitable for experimental purposes, and an automatic plant, capable of handling various sized springs at the rate of approximately 200 per hour, is now being developed.

Fatigue Testing of Springs

The springs tested are designed to have a safe working stress at closure. It was impossible, therefore, to impose stresses above the fatigue limit by means of the conventional type of reciprocating test. For this reason, a special test machine was designed to provide consistent results. In the test, the spring is bent axially to form an arc of known radius. Rotation of the spring about its axis then imposes torsion and bending stresses in the wire.

One of these machines, capable of testing three specimens at a time, is shown in Fig. 5. The fractional horsepower electric motor *A* drives one end of the spring through a spindle and collet arrangement *B*, the other end of the spring being held by a similar collet and ball-bearing mounted spindle in the support *C*. The spring forms part of an electrical circuit with a relay carrying a small current, which switches off the motor when the spring fractures.

Any specific stress within the limits of the machine can be obtained by locating the spring support *C* in the appropriate dowel-hole *D*, and setting the front of this component to the cor-

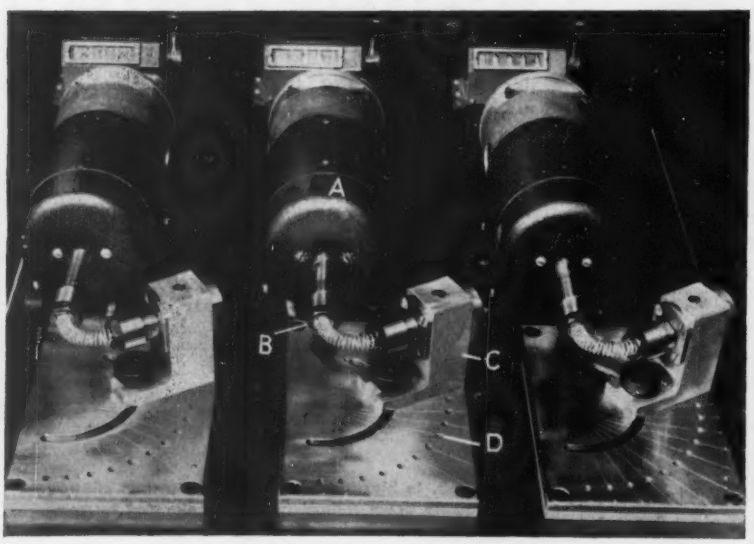


Fig. 5. Special machine capable of testing fatigue of three springs at the same time. Springs are bent and rotated to impose tension and bending stresses in wire.

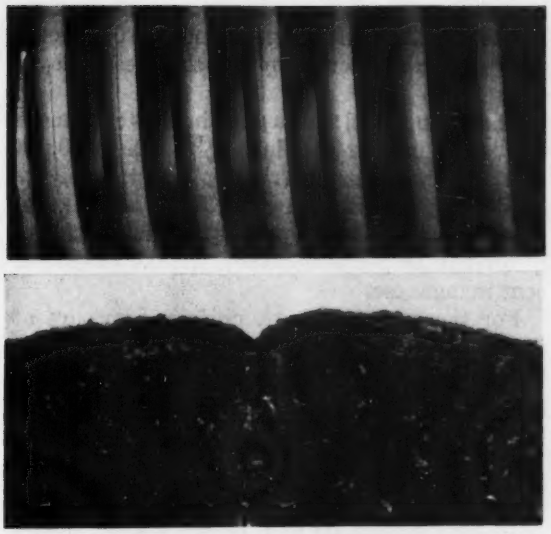


Fig. 6. (Top) Liquid abrasive blasting revealed seam in 0.040 inch diameter wire spring, and (bottom) transverse section through defect shown in spring at top.

responding engraved line on the baseplate, which is tangential to the spring at this position. Since the series of dowel-holes is arranged in the form of an involute curve, the curvature of the spring is maintained truly circular at any setting between the positions of minimum and maximum stress.

Owing to the difficulty of calculating the stress in the wire at various spring radii, all the fatigue tests were carried out on a comparative basis, the results being expressed as a percentage increase or decrease in the fatigue limit, compared with "as received" springs. It is important to note, however, that the stress for a given design of spring is inversely proportional to the radius of curvature of the spring, and proportional to the angle of the movable support from the zero stress position. Hence, a typical fatigue curve can be obtained by plotting this angle against the number of cycles at which failure occurs.

Values of spring life were obtained at stresses ranging from the fatigue limit of the "as received" specimens, increasing by 12 per cent increments to 120 per cent above that fatigue limit. Springs made from sub-standard quality wire and blasted with 177 micron abrasive showed a 50 per cent improvement in fatigue limit, while those treated with 125 micron abrasive had a 75 per cent increase.

Process Control and Inspection

Successful liquid abrasive blasting of large quantities of springs under production conditions depends upon the accurate control of three factors: (1) the time for which the springs are exposed to the blast; (2) uniform coverage of the whole surfaces of the springs; and (3) the maintenance of the correct concentration of the abrasive.

Experience gained so far indicates that the breakdown of the abrasive is not rapid, and may, in any event, be allowed to continue until the broken particles form 10 per cent of the charge by volume. In order to check this percentage under production conditions, samples of the abrasive-water mixture are taken from the nozzle in a measuring cylinder. If, after settling out, the volume of broken particles exceeds 10 per cent, the charge is drained out and the good abrasive reclaimed by settling.

The inspection of treated springs affords a further check on the correct functioning of the plant. The form of inspection, and the frequency with which the checks are made, will, of course, depend on the duty to be performed by the springs. For aircraft applications, where failures cannot be tolerated, the following procedure has been found satisfactory:

1. Springs from the same batch, or preferably from the same coil of wire, as those to be treated, are examined microscopically to determine the amount of material to be removed.
2. One spring in twenty-five is uncoiled after

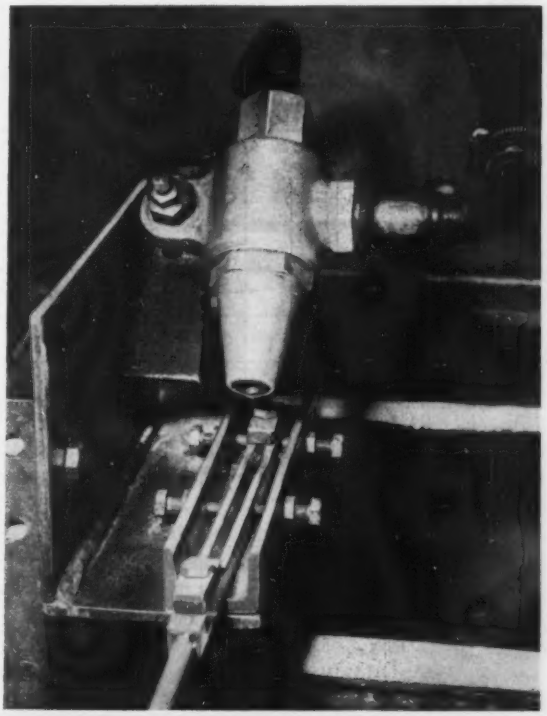


Fig. 7. Jig employed for liquid abrasive blasting of flat strips. Uniform exposure is obtained by traversing jig at a set distance from nozzle.

blasting and the diameter is compared with that of an untreated spring from the same batch, to insure that the correct amount of material has been removed.

3. Each spring is inspected under a binocular microscope for gross surface defects. This procedure has been found necessary because an occasional spring in a batch sometimes contains isolated defects of the kind shown in Fig. 6, which did not occur in the control sample.

Such flaws are often too deep to be removed, but liquid abrasive blasting has the desirable result of widening the outer extremity of the defect, thus rendering it more easily visible. In this respect, the process is more satisfactory than most forms of flaw detection.

Variables in the Process

There is evidence to show that liquid abrasive blasting induces considerable compressive stresses in the surface layers of the treated part. For instance, sheet metal blasted only on one side becomes distorted and assumes a convex shape on the treated side. This stressed layer is thought to have a beneficial effect on the fatigue properties of springs.

The depth and magnitude of these stresses were determined by the use of a technique developed for measuring the stress intensity produced by shot-peening. With this method, a thin flat strip of steel is exposed to the blast on one side, which stretches the surface, and thus induces residual compressive stresses in the outer layers. Bending of the strip occurs, and the camber, or height, of the arc produced is proportional to the moment exerted by the compressed layer of metal.

The spring steel strips used in the tests under discussion measured 6 inches by 0.25 by 0.021 inch, and were made from rolled strip in the hardened and tempered condition. The chemical composition of the strips was within the range of 0.7 to 0.18 per cent carbon and 0.4 to 0.5 per cent manganese.

For the series of tests, uniform exposure of the strips to the blast was insured by mounting them in the jig shown in Fig. 7, which was arranged to traverse backward and forward at a set distance from the blast. All other conditions were maintained constant, and for this test were as follows:

1. Air pressure on gun, 80 pounds per square inch;
2. Abrasive particle size, 125 microns;
3. Nozzle to test piece distance, 2 1/2 inches;
4. Nozzle angle in relation to strip, 45 or 90 degrees;
5. Time of exposure to blast, five seconds;
6. Longitudinal movement of strip, 4 inches per second (approximately);
7. Number of test strips, three per test.

The arc height produced by the above treatment was measured at the center of the middle 3-inch specimen.

Surface layers were then removed in 0.0001 inch increments by immersing the strips in a 10 per cent solution of nitric acid in water, and the

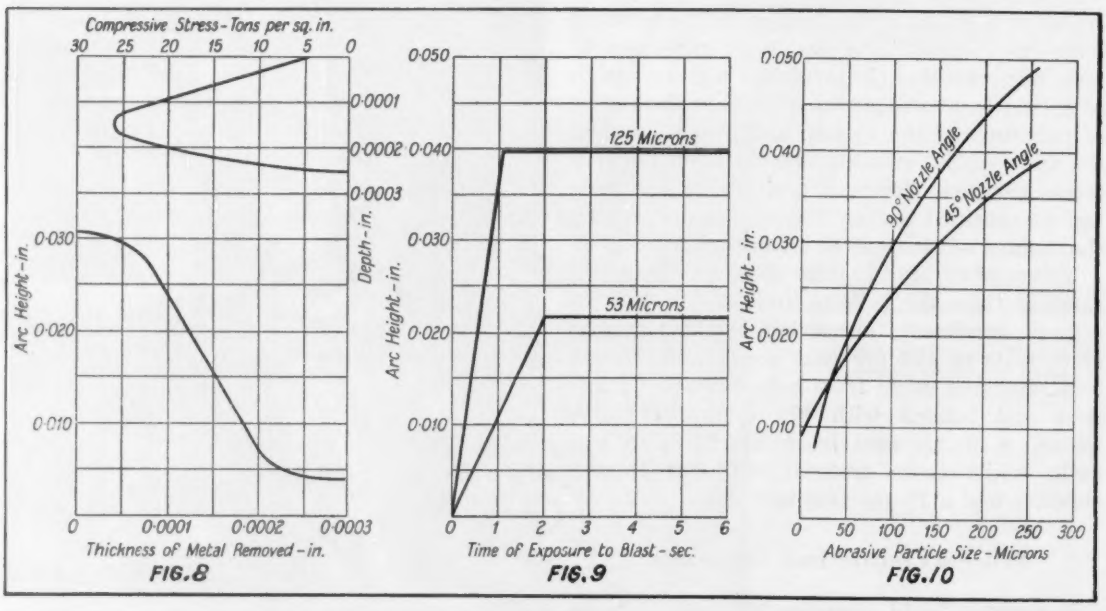


Fig. 8. (Bottom) Arc height plotted against thickness of metal removed, and (top) amount and distribution of stress in surface layers. Fig. 9. Relationship between arc height and time of exposure. Fig. 10. Relationship between arc height and abrasive particle size for nozzle angles of 45 and 90 degrees.

process was repeated until no further change in arc height occurred. After the removal of each successive layer, the new arc height and total thickness of the strip were measured. A typical plot of arc height against thickness of metal removed is shown by the curve in Fig. 8. The calculated stress values obtained have been plotted against the corresponding depth below the surface, which shows the value and distribution of stress in the surface layers of the strip.

Effect of Time of Exposure

The time of exposure to the blast required to produce maximum arc height, and therefore maximum peening intensity or stress, was determined by blasting the flat spring steel test pieces for periods ranging from one-half second to five seconds.

Two series of tests were made, one with abrasive having a mean particle size of 125 microns (100 grit), and the other with a similar abrasive having a mean particle size of 53 microns (240 grit). The axis of the nozzle was set at an angle of 90 degrees to the surface of the test strips, and all other conditions were maintained constant as in the previous test.

The results of the tests, which are shown graphically in Fig. 9, indicate that the strips are deformed to maximum arc height, and are consequently peened to maximum intensity, in the surprisingly short exposure to the blast of one to two seconds.

Effect of Abrasive Particle Size

In this test, a series of steel strips was blasted on one side only, with abrasive ranging in particle size from 4.7 to 250 microns, all other conditions being the same as in the first test. The arc height of the resulting curved strips gave a measure of the induced stress intensity produced by each grade of abrasive. It will be seen from Fig. 10 that the stress intensity, as indicated by arc height, is roughly proportional to the mean particle size of the abrasive.

The small difference in stress produced by widely different nozzle angles, or angles of impingement of the abrasive particles, is also shown in Fig. 10. One explanation for this small difference may be that the treatment time was in excess of that required for complete work hardening, even at the less effective angle of 45 degrees. The slightly lower stresses produced at this angle may be due to the comparatively high rate at which the work-hardened surface is removed, the rate of metal removal being much lower at an angle of 90 degrees.

The steel strip test specimens blasted under

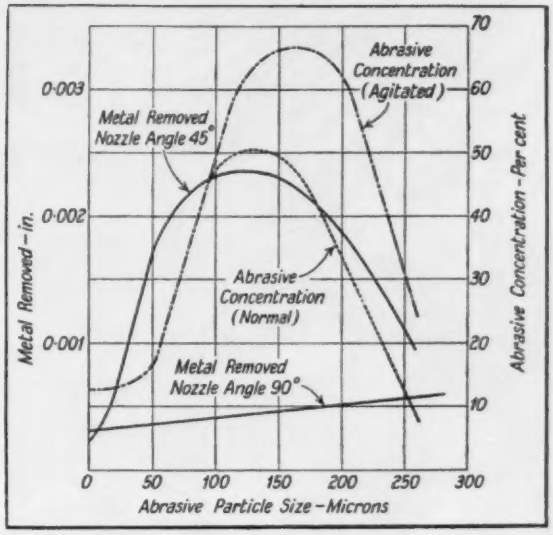


Fig. 11. Relationship between metal removed in five minutes by liquid abrasive blasting and particle size. Effect of particle size on concentration (with and without agitation) is also indicated.

the conditions outlined for this last test were measured for thickness before and after treatment with different grades of abrasive, and the values of thickness of metal removed were plotted against abrasive particle size. As seen in Fig. 11, the rate of metal removal with the nozzle set at an angle of 45 degrees does not increase in direct proportion to the size of the abrasive particles over the full range of sizes.

A further series of tests, made to determine the percentage of abrasive to water issuing from the nozzle, indicated that the decrease in metal removal rate with abrasive of over 125 microns (100 mesh) was due to a marked reduction in abrasive concentration when working with particle sizes of 125 microns and larger, as also indicated in Fig. 11. The peak of the abrasive concentration curve coincides with that of the metal removal curve.

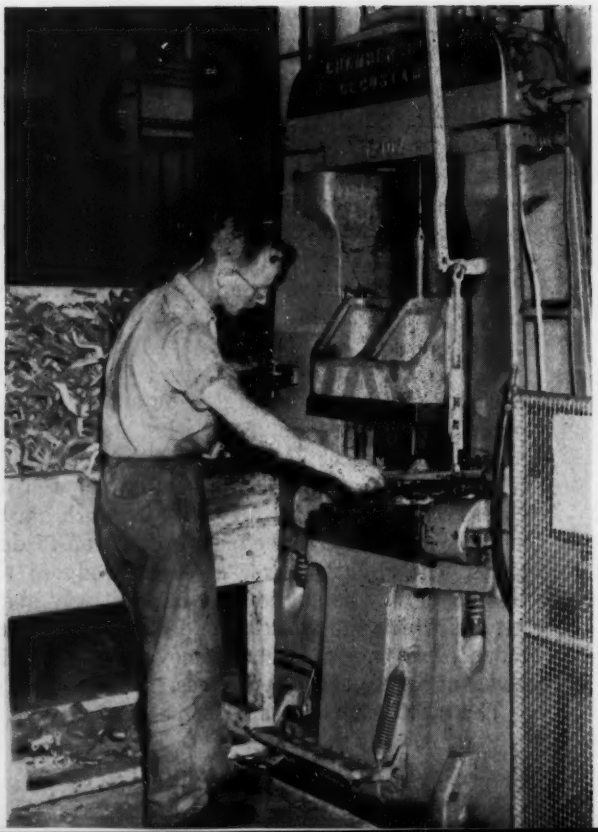
Further tests were then made using air agitation of the abrasive-water mixture in the sump of the machine, and the results obtained showed an improvement in concentration at the nozzle exit of 15 per cent for the heavier abrasives. It may be noted that agitation resulted in a corresponding improvement in the metal removal rate with the heavier abrasives.

Tests made to determine the effect of nozzle angle on metal removal showed that an increase in this angle relative to the test strip surface produced a decrease in the rate of removal, which reached a minimum value at an angle of 90 degrees. The optimum angle appeared to be 45 degrees.

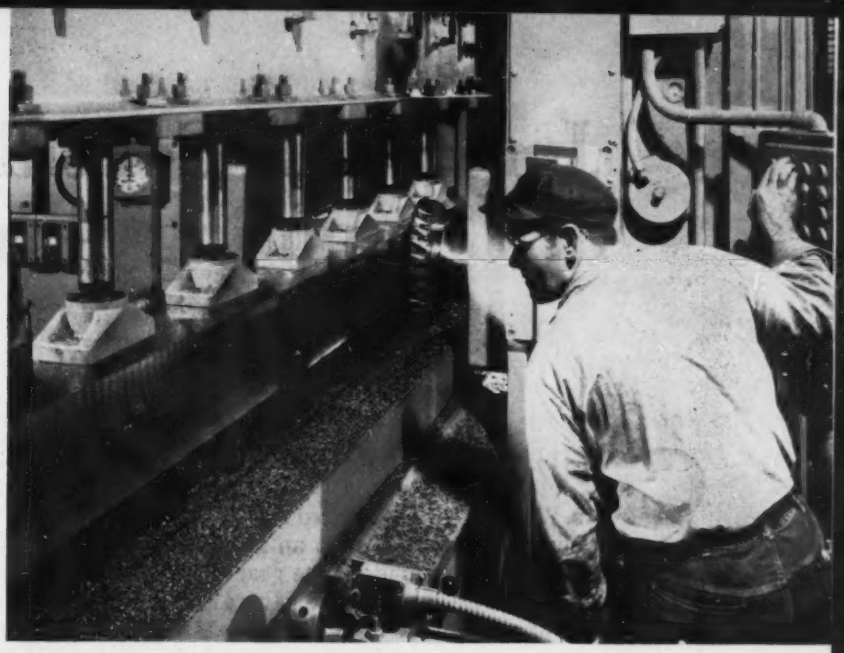
In Shops Around the Country

Camera highlights of some interesting operations performed in various metal-working plants throughout the nation

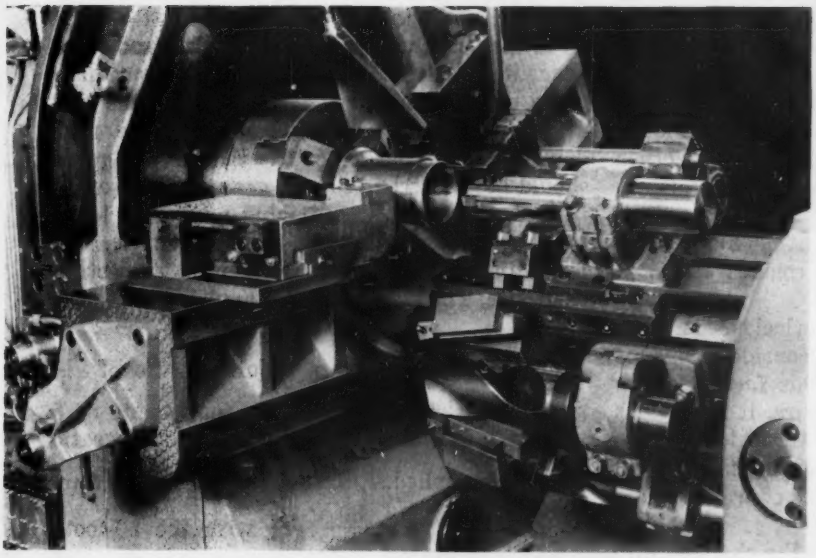
Machining one end of drill pipe length on the turret lathe shown in the foreground at the Ambridge, Pa., plant of the Spang-Chalfant Division of the National Supply Co. Following this, the lathe seen in the background machines the opposite end. The entire hexagon turret is replaced when changing over to different diameter pipe. Handling rack simplifies machine loading and unloading.



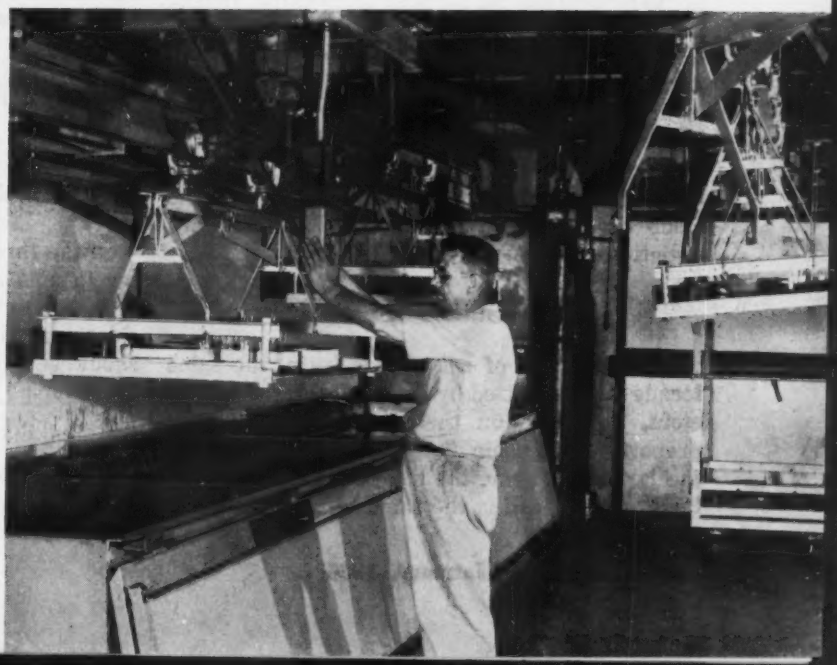
Straightening malleable iron castings in a large foundry by the use of a Chambersburg Cecostamp. This pneumatically raised gravity drop-hammer provides flexible blow control, permitting any variation of stroke without the necessity of friction or stroke adjustment. Dies for straightening or coining may be made of cast iron or machined tool steel.



Edge-finishing a stack of cold-rolled steel bars at the Pittsburgh Works of the Jones & Laughlin Steel Corporation. Thirty-two bars 1/4-inch thick are handled at a time. This duplex milling machine uses two 15-inch diameter carbide-tipped cutters operating at a surface speed of up to 450 feet per minute with a roughing feed rate of 32 inches per minute.



Close-up view of tooling on a 12-inch Acme-Gridley single-spindle automatic chucking machine. A total of fourteen machining cuts are taken in this set-up on an SAE 4150 steel slug to form a master collet blank. After the operator loads and starts the machine, all cuts in the cycle are automatically performed.



Dipping coils for alternating-current welders in silicone varnish at the York, Pa., plant of the General Electric Co.'s Welding Department. The coils are lowered into and raised from the tanks at the push of a button. Following dipping, the racks of coils are placed on overhead conveyors to be transported to ovens.

Important Considerations in Computing Gear Trains

By Otto Lichtwitz
London, England

COMPUTING of gear trains is the predominant problem associated with change-gears. When a gear is produced either with the wrong number of teeth or with an incorrect helix angle, neglect in computing the gear train is immediately revealed. However, there are other aspects of change-gear computation which in most cases are unintentionally overlooked, and the neglect cannot be proved merely by examination.

Many engineers fail to realize that the number of teeth are not the only consideration in computing gear trains until, on attempting to mount them, the gears either interfere with each other or with a part of the machine, or else they do not connect the distance between the shafts. Such troubles are almost invariably avoidable because they are based on insufficient considerations in specifying a gear train.

Another aspect often overlooked is that change-gears are subject to considerations of strength. Although ignoring this factor seldom leads to destruction of the gears, it is obvious that an arrangement of the gears which reduces the loads on the teeth guarantees a longer useful life of the gears and a more exact transmission of the motion.

Additional problems arise if the change-gears are to be used for the purpose of indexing. Indexing depends on the number of teeth and the locations in which the gears are mounted. Fortunately, the same simple rule can be applied to mountability and considerations of strength. However, the requirements for indexing are independent of, and in some cases even contrary to, those for mountability and for reducing the loads on the teeth, so that compromises are sometimes necessary.

Considerations of Strength

If, in the case of a two-gear train, the same torque is transmitted by gears of different diameters, the loads on their teeth are inversely proportional to their diameters. In other words, the larger the gear, the smaller the load on its teeth. As the load is the same for both meshing gears, they should be chosen as large as possible. The gear train ratios $\frac{60}{90}$ and $\frac{20}{30}$ are equivalent, but in the former train, the stress on the teeth is reduced to one-third that of the latter.

In the case of a four-gear train, similar considerations lead to the advisability of large gears on the driving and driven shafts. The loads on the teeth of the intermediate gears are the same as on the gears with which they mesh, and independent of their size. Thus, the intermediate gears need not be large. The larger of the two driving gears, therefore, should be the first driver, and the larger of the two driven gears should be the second driven gear. Or, expressed in a simpler form, the driving gears should be mounted in descending, and the driven gears in ascending order of magnitude with respect to their size. The same rule also applies to six-gear trains.

For example, if for a required ratio of $\frac{4}{13}$, gears with 20 to 120 teeth in increments of 5 teeth are available, the simple gear train ratio $\frac{20}{65}$ can be applied. By using the equivalent compound gear train $\frac{80 \times 30}{65 \times 120}$ with the 80-tooth gear on the driving shaft and the 120-tooth gear on the driven shaft, the load on the teeth of the driving gear is reduced to $\frac{20}{80}$, or 25 per cent, and the load on the teeth of the driven gear to $\frac{65}{120}$, or 54 per cent.

Considerations of Mountability

In the three-gear train shown in Fig. 1, driving gear A and driven gear B mesh with idler gear C. The center-to-center distance Y is a machine constant, which, like the diametral pitch P, should be known when determining a gear train. The over-all diameter of a gear usually exceeds the pitch diameter by $\frac{2}{P}$, or it is the same as the pitch diameter of a gear which has two additional teeth. If a denotes the number of teeth on gear

A, and if b and c are used in the same sense, the conditions under which the driving and driven gears would not mesh directly are when

$$a + b \text{ is less than } 2YP - 4 \qquad (1)$$

On the other hand, the broken line ACB in Fig. 1 must be at least as long as the center distance AB, or

$$a + b \text{ is less than } 2YP - 4 \qquad (1)$$

For an example, it can be assumed that the center distance Y equals 9 1/2 inches, the diametral pitch P equals 12, the required ratio is $\frac{11}{12}$, and change-gears are available having from 20 to 120 teeth in 5-tooth increments with the 20-tooth gear in duplicate. Both the gear trains $\frac{55}{60}$ and $\frac{110}{120}$ are equal to the required ratio of $\frac{11}{12}$. With the quantity $2YP$ equal to $2 \times 9\ 1/2 \times 12$, or 228, Formula (1) indicates that $a + b$ should be less than 228 — 4, or 224. This excludes the gear train $\frac{110}{120}$, since $110 + 120 = 230$.

Formula (2) indicates that $a + b + 2c$ should be greater than 228. Since $a + b = 55 + 60 = 115$, it follows that $2c$ should be greater than 228 —115, or 113, and c greater than 56 1/2. As the only available 60-tooth gear is used as the driven gear, any of the gears with 65 teeth or more are suitable for the idler gear C.

In Fig. 2, a four-gear train is shown. A small gear E, or a washer, is often used as a spacer. To prevent gear E from meshing with gear C, $a + b$ must be greater than $e + c + 4$. If a is greater than c, and if e is less than $b - 4$ (that is, if the spacer gear has at least 4 teeth less than the first driven gear), the necessary conditions are fulfilled. Also, d should be greater than b to prevent interference between the lock-nut F and the gear B. The two conditions—a greater than c and d greater than b—express the previously found rule that the driving gears should be mounted in descending and the driven gears in ascending order.

In the case of a three-gear train, a sufficiently large gear can be used as idler C to insure that the gears bridge the center-to-center distance Y. However, in the case of a four-gear train, the intermediate gears cannot be chosen arbitrarily and $a + b + c + d$ has to be greater than $2YP$. (3)

For example, it can be assumed that the ratio $\frac{5}{39}$ is required on the same machine as in the previous example. As a three-gear train cannot be used, the four-gear trains $\frac{25 \times 20}{60 \times 65}$, $\frac{40 \times 25}{65 \times 125}$ and $\frac{50 \times 20}{65 \times 120}$ are to be considered. The sums of all four gears in these trains are 170, 255, and 255, respectively. As 170 is less than the minimum of 228 teeth required, the first gear train considered cannot be used. Also, the train $\frac{50 \times 20}{65 \times 120}$ is preferable to $\frac{40 \times 25}{65 \times 120}$ as a larger gear can be placed on the driving shaft. A spacer gear E having 20 teeth would not interfere with the second driven gear, since $d + e$ would equal 120 + 20, or 140, which is well below 224.

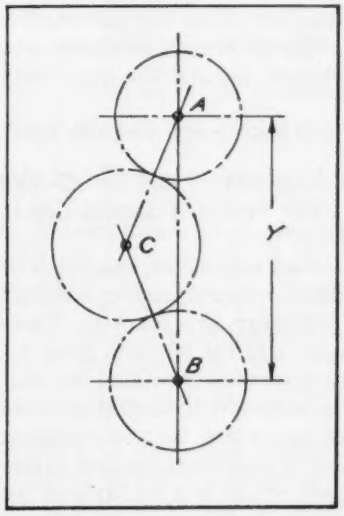


Fig. 1. In a three-gear train, broken line (ACB) must be at least as long as the center distance (AB).

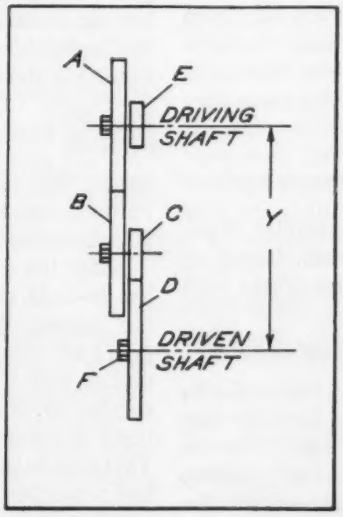


Fig. 2. Spacer gear (E) should have at least four teeth less than first driven gear (C) to prevent interference.

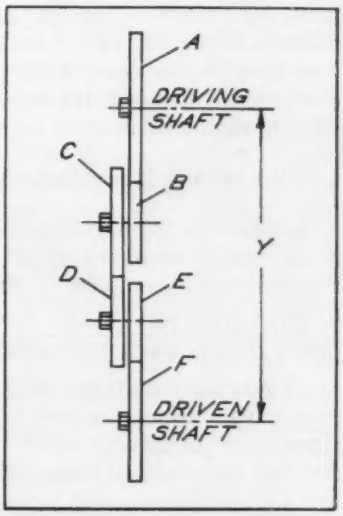


Fig. 3. Sum of teeth on all six gears must exceed two times the center distance (Y) times diametral pitch.

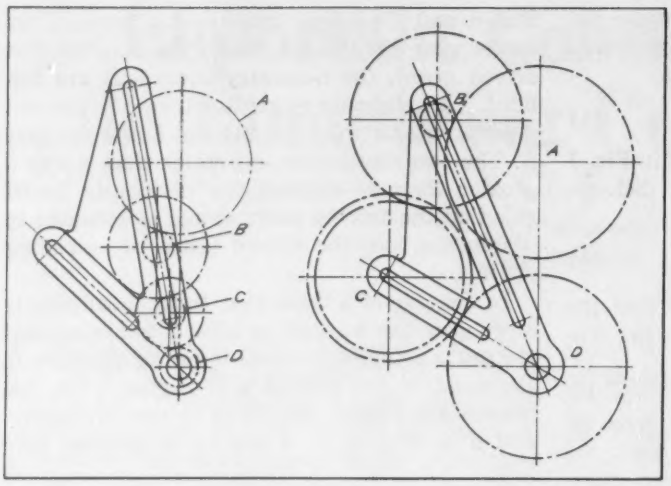


Fig. 4. (Left) when line connecting centers of gears closely approximates a straight line, there is little chance of interference. (Right) With gears mounted on same quadrant as seen at left, but with centers far from aligned, gears may be close.

Six-gear trains are usually mounted in two planes, as shown in Fig. 3, an arrangement which involves several risks of interference in the plane in which there are four gears. Considerations similar to those for four-gear trains lead also to the rule: driving gears descending, driven gears ascending. Further, the distance Y is bridged if $a + b + c + d + e + f$ is greater than $2YP$. (4)

However, the two rules are a guarantee for the mountability of a six-gear train only if a line connecting the centers of the gears A, B, C, and D (Fig. 4) does not vary much from a straight line connecting the centers of gears A and D. In the gear train at the left, the centers of gears A, B, C, and D are almost aligned and there is obviously no risk of interference. In the train at the right, which has the same center distance AD and with the gears mounted on the same quadrant, the centers of the four gears are far from aligned. While there is no interference, it can be seen that the first and third driving gears, and the first driving and third driven gear, come very close to each other.

If the ratio $\frac{3}{49}$ is required on the same machine as assumed in the previous two examples, there is no possible two- or four-gear train. However, the ratio can be satisfied by six-gear trains such as $\frac{30 \times 20 \times 20}{35 \times 70 \times 80}$ or $\frac{90 \times 30 \times 20}{70 \times 105 \times 120}$. The sums of all gear teeth on these trains are 255 and 435, respectively, which are both larger than the machine constant 228. Since 255 is fairly close to 228, the centers of all gears will be nearly in line, and no interference will be encountered for the gear train $\frac{30 \times 20 \times 20}{35 \times 70 \times 80}$. It will depend, of course, on the design of the machine whether or not the gear train $\frac{90 \times 30 \times 20}{70 \times 105 \times 120}$ can be mounted without interference.

By conforming with the recommendations described, almost all six-gear trains can be mounted without interference. However, there are some rare exceptions, such as in the gear train $\frac{53 \times 53 \times 53}{59 \times 59 \times 59}$ where interference is encountered. In such a case, it will not be difficult to compute another gear train.

Indexing by Means of Change-Gears

If a lathe is not equipped with an indexing faceplate for multiple thread cutting, the change-gears are often employed for indexing. The following examples are based on the assumption that substitute gear trains are not available. For cutting a double thread, assume the gear train $\frac{90 \times 35}{85 \times 95}$ is used, with the 90- and 35-tooth gears as the first and second drivers and the 85- and 95-tooth gears as the first and second driven gears, respectively.

After the first thread is finished, one tooth of the 90-tooth gear and the corresponding space on the mating 85-tooth gear are marked. These gears are disengaged, and the 90-tooth gear, together with the work-spindle, is rotated one-half revolution. This is achieved by rotating it 45 teeth further. The gears are then re-engaged. This simple indexing is possible if the first driver has a number of teeth which is a multiple of the number to be indexed—in this case, 90 being a multiple of 2.

Indexing is not always bound by this condition. For example, assume that a double thread is to

be cut with the gear train $\frac{115 \times 20}{85 \times 90}$. The task of indexing can apparently be reduced to the method just described if the 20-tooth gear were used as the first driver. However, the 115-tooth gear as second driver would, in most cases, cause interference with the lock-nut in front of the first driver. With the 20-tooth gear as second driver, the work can be rotated 180 degrees while the tool remains unchanged. For this purpose, the 20- and 90-tooth gears are disengaged, not the 115- and 85-tooth gears. As one revolution of the combined 20- and 85-tooth gears results in $\frac{85}{115}$ revolution of the spindle, $\frac{115}{2}$ revolutions of the gears on the stud impart to the spindle $\frac{85}{115} \times \frac{115}{2}$, or 42 1/2 revolutions. The $\frac{115}{2}$, or 57 1/2, revolutions can easily be imparted to the 20-tooth gear by making 57 full turns and a movement corresponding to 10 teeth.

In this example, the number of revolutions imparted to the second driver was the number of teeth of the first driver (115) divided by the number to be indexed (2). The number of revolutions of the work was the number of teeth of the first driven gear (85) divided by the number to be indexed (2).

If the gear train were arranged $\frac{115 \times 20}{90 \times 85}$, with the 90-tooth gear as the first driven gear, the indexing procedure described would cause the work to make $\frac{90}{2}$, or 45, revolutions. However, any whole number of revolutions does not alter the relative position of tool and work. If the $\frac{115}{2}$ revolutions of the gears on the stud are reduced to half the amount, the required effect is obtained as the work-spindle makes $\frac{115 \times 90}{4 \times 115}$, or $\frac{45}{2}$ revolutions. The 20-tooth gear can easily be rotated $\frac{115}{4}$, or $28\frac{15}{20}$, revolutions.

The general criterion as to whether indexing can be performed by means of the second driver gear is that the ratio of $\frac{\text{second driving gear}}{\text{first driven gear}}$, reduced to its lowest terms, has a numerator divisible by the number to be indexed. Indexing can be performed in the same way as the last example if neither driving gear alone is divisible by the number to be indexed, but if their product is divisible by it.

It can be assumed that a six-start thread is to be cut with the gear train $\frac{100 \times 75}{55 \times 65}$. Neither 100 nor 75 is divisible by 6, but the former is divisible by 2, and the latter by 3, so that their product is divisible by 6. Here again, the second driver is used for indexing. As one revolution of the gears on the stud corresponds to $\frac{55}{100}$ revolution of the spindle, $\frac{100}{6}$, or 16 2/3, revolutions (16 full turns + 50 teeth of the 75-tooth gear) correspond to $\frac{55}{100} \times \frac{100}{6}$, or 9 1/6 turns of the spindle.

Six-gear trains are used mostly for obtaining a lead smaller than can be obtained by a four-gear train, and it is improbable that a multiple-start thread would have such a small lead. However, six-gear trains are also a means of avoiding unsuitable four-gear trains.

For example, assume that a four-start thread is to be cut with the gear train $\frac{65 \times 55}{105 \times 115}$. Indexing is impossible, since neither 65 nor 55, nor their product, is divisible by 4. The equivalent six-gear train $\frac{80 \times 65 \times 55}{70 \times 115 \times 120}$, with the 80-tooth gear as first driver, makes indexing possible; and it also reduces the load on the teeth.

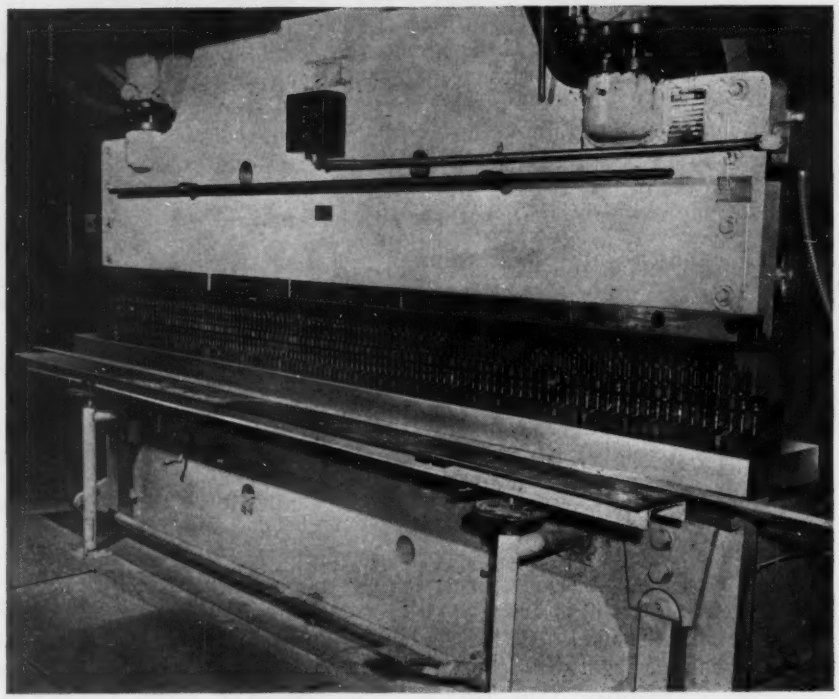
In a six-gear train, indexing can likewise be performed by means of a suitable second or third driving gear, the calculations being analogous to those for four-gear trains. Assume that a three-start thread is to be cut with either a four-gear train $\frac{115 \times 85}{65 \times 105}$, or a six-gear train $\frac{115 \times 85 \times 60}{65 \times 70 \times 90}$. It was found that the 60-tooth gear could only be mounted as third driver.

It can be imagined that the first two drivers are replaced by a gear having 115×85, or 9775 teeth, and the first two driven gears by a gear having 65×70, or 4550, teeth. This imaginary gear train then appears as the four-gear train $\frac{9775 \times 60}{4550 \times 90}$, or $\frac{391 \times 60}{182 \times 90}$. As in the previous examples, the 60- and 90-tooth gears are disengaged. The 60-tooth gear is rotated $\frac{391}{3}$, or $130\frac{20}{60}$ revolutions, causing the 115-tooth gear to make $\frac{182}{3}$, or $60\frac{2}{3}$ revolutions, which are suitable for dividing the work into three parts.

This last example has a purely theoretical significance, as rotating a gear more than 100 times is impracticable. Nevertheless it does show that indexing can be performed under the most exacting conditions.

Press-Brake Punching Utilizes Magnetic Chuck

By Crosby Harden



A MAGNETIC chuck is adding flexibility to press-brake punching at the El Segundo, Calif., Division of the Douglas Aircraft Co. The chuck provides an effective grip for the sets of Wales C type hole-punching units used on stringers, channels, angles, and other aircraft shapes.

In customary operations of this kind, each unit is bolted mechanically to the press-brake rail. For this purpose, the rail has a raised strip section and a T-slot, and the base of the unit has a keyway and a T-bolt retaining hole. Templates are used to space the units at the required center distances. However, there is no provision for any front-to-rear adjustment of the units.

Now, with a Sundstrand chuck replacing the rail, the units have complete latitude of front-to-rear adjustment. It is possible to punch more than a single row of holes at the same time. Also, irregular hole patterns can be handled. Where short work lengths permit several jobs to be punched simultaneously, sets of units can be located on the chuck independently of each other.

In Fig. 1, the Verson press brake, on which the magnetic chuck is mounted, is set up for the line punching of the flat strip seen on the table. With the chuck de-energized, the 112-hole punching units are rapidly positioned with the aid of a template.

Another view, Fig. 2, shows three jobs in progress simultaneously. The operator in the foreground is using two sets of units for punching holes in the two halves of an angle-piece.

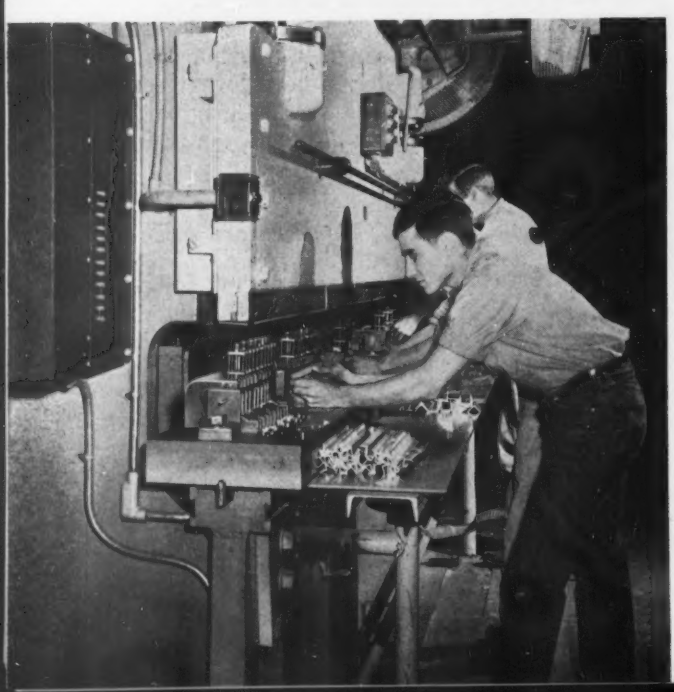


Fig. 1. (Above) With no T-bolts to insert and tighten, set-up time for the 112-hole punching units is greatly reduced.

Fig. 2. (Left) Unrestricted by any keyway engagement, each unit can be given an independent front-to-rear location.

Crankshaft-Pin Grinding Made Completely Automatic

SUCCESSFUL application of automation to the intricate and exacting operation of grinding crankshaft pins has been realized with the introduction of a new machine by the Norton Co., Worcester, Mass. With this transfer type crankpin grinder, shown in Fig. 1, all the manual motions previously required of operators are mechanized. Adjusting, gaging, and transferring of the work, as well as the precision grinding, are completely automatic.

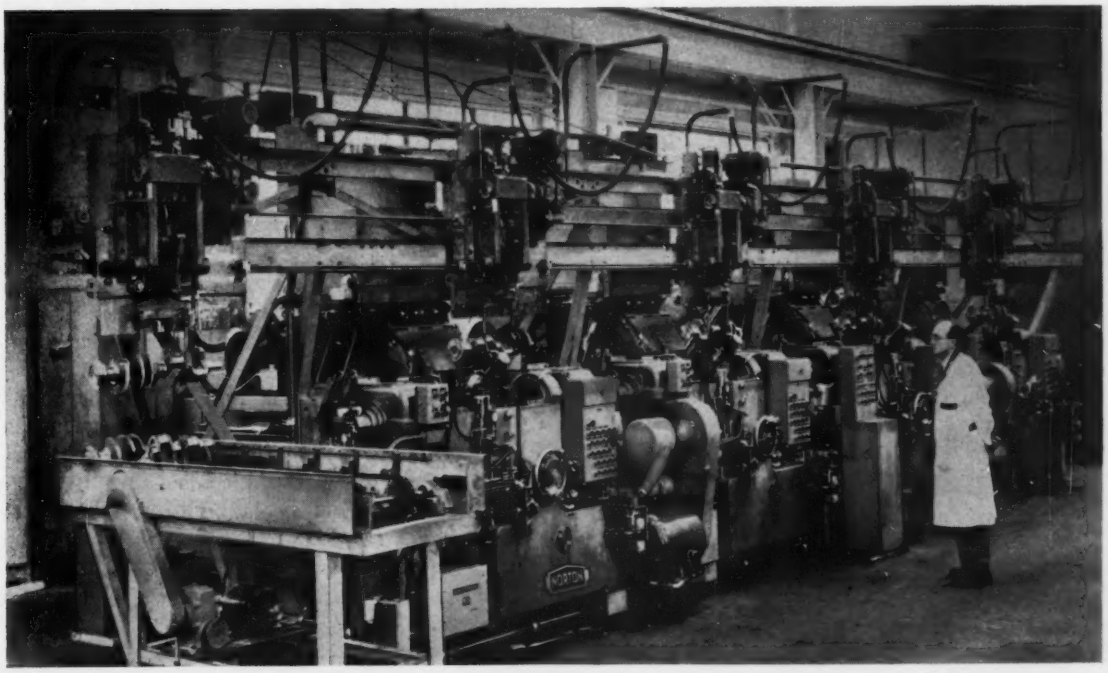
The machine has basically four stations and four wheels for grinding the pins of V-8 engine crankshafts, but it can be applied to six-cylinder engine shafts by the addition of two grinding stations. It is arranged to pick up crankshafts from a conveyor line or loading station, automatically transfer and locate the work in four successive grinding stations, and place the finished shafts on a conveyor or into an unloading station—all without human effort.

The estimated production rate is one crankshaft per minute, which equals the output of six conventional crankpin grinders set up for semi-automatic operation. The first transfer type crankpin grinding machine will be installed at the Utica, Mich., plant of the Studebaker-Packard Corporation.

The machine has two base units, each carrying two grinding-wheel slides, and the transfer units are mounted over the four grinding stations. Five transfer units equipped with lifting hooks travel vertically to pick up and deposit the crankshafts at each station, moving simultaneously. These units are joined together, moving in unison horizontally to provide automatic transfer of the work-pieces.

In addition to the lifting hooks, each transfer station contains a locating hook for roughly positioning the shaft angularly. When a shaft is deposited in any grinding station, a rotating cam locates it longitudinally in front of the grinding wheel, and a locating arm adjusts it angularly to the proper radial position for grinding the crankpin. Final angular location is obtained by a locating pin which engages a hole in the crankshaft flange.

Fig. 1. Over-all view of automated transfer type crankpin grinder taken during construction. Cranks are picked up from conveyor and transferred through each of the four grinding stations before being placed on another conveyor.



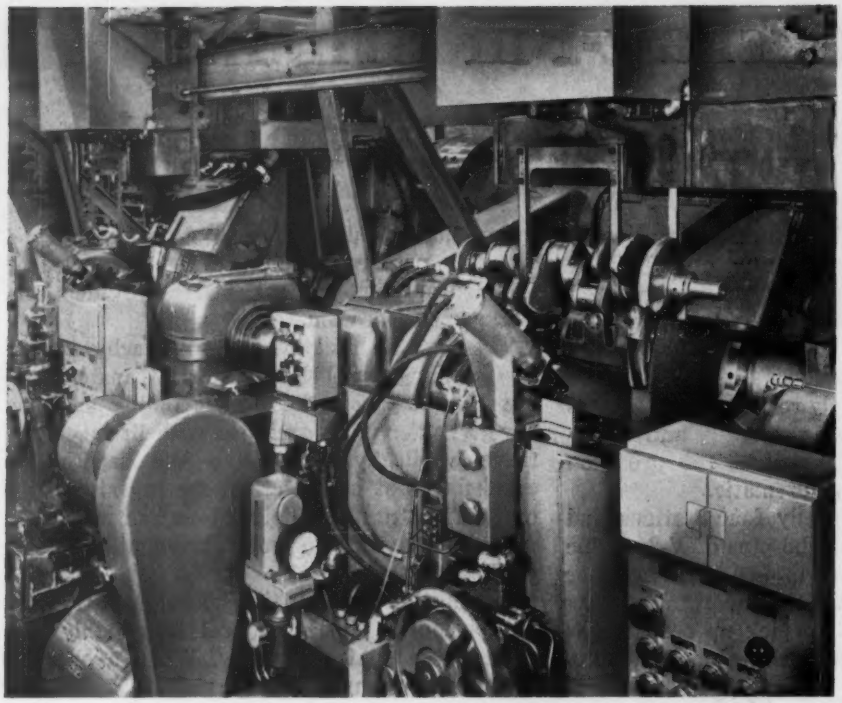


Fig. 2. Close-up view of one of the four grinding stations of the transfer type crankpin grinder. Size is controlled by the air snap gage just under the crank which is being lowered by the transfer hook into the work-heads.

Each grinding wheel is equipped with a completely automatic truing mechanism which will true the wheel face and the radius at each corner at every work cycle or after any pre-set number of cycles. This eliminates the human element, with the corresponding natural tendency of most operators to remove too much of the wheel surface in the truing operation. Thus, it is expected that grinding wheel life will be many times that of wheels used on conventional crankpin grinders. Automatic compensation is provided for the amount of abrasive removed at each truing, and the wheel-drive motors are arranged to vary their speed. This variation provides a constant peripheral speed as the grinding wheel wears down toward discard size.

In-feed of the grinding wheels, spark-out, and work size are automatically controlled by air-operated snap type gages which measure the pin diameters during grinding. In Fig. 2, which is a close-up view of one of the four grinding stations of the Norton transfer type crankpin grinder, an air snap gage is shown just under the crankshaft which is being lowered by the transfer hook into the work-heads. An amber light is flashed on as the gage is actuated. When the work reaches approach size (0.0015 inch over size), a green light goes on and slow in-feed of the wheel is initiated. A red light goes on when the required finish size is reached. Simultaneously, the grinding wheel-slide is automatically retracted, and is ready for the next cycle.

Two Machine Tool Builders Announce Merchandising Plans

The Van Norman Co., Springfield, Mass., has announced a merchandising plan that features long-term leases and a ten-year installment sales plan developed to take advantage of the fast depreciation schedules now allowed by the Government. Buyers can choose any of the five following ways to acquire Van Norman machinery: (1) a straight cash purchase; (2) a lease plan running to nine years under which monthly rentals can be written off as expense; (3) a lease plan with an option to buy; (4) an installment plan with equal monthly payments and terms running to five years; or (5) a pay-as-you-depreciate plan with terms up to ten years and payments geared to match depreciation allowances under the new tax law.

The Norton Co., Worcester, Mass., has also announced arrangements for leasing, rebuilding, trading in, and time payment of some of the standard grinding and lapping machinery built by the concern. The leasing arrangement is similar to that of the Kearney & Trecker Corporation, outlined in March, 1954, MACHINERY, page 205. In expanding rebuilding operations, a machine can be rebuilt for 45 per cent of the price of a corresponding new machine. In many replacement programs, original equipment can be taken in trade. Time payments for new machines can be arranged through distributors.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Coordinate Hole Spacing Jig

By H. J. GERBER, Stillwater, Okla.

For the small shop faced with the problem of making a simple plate jig or a blanking or piercing die without access to a jig borer, the device illustrated proves practical. Is is usable on any drill press in good condition, permitting holes to be held to a spacing accuracy of 0.001 inch.

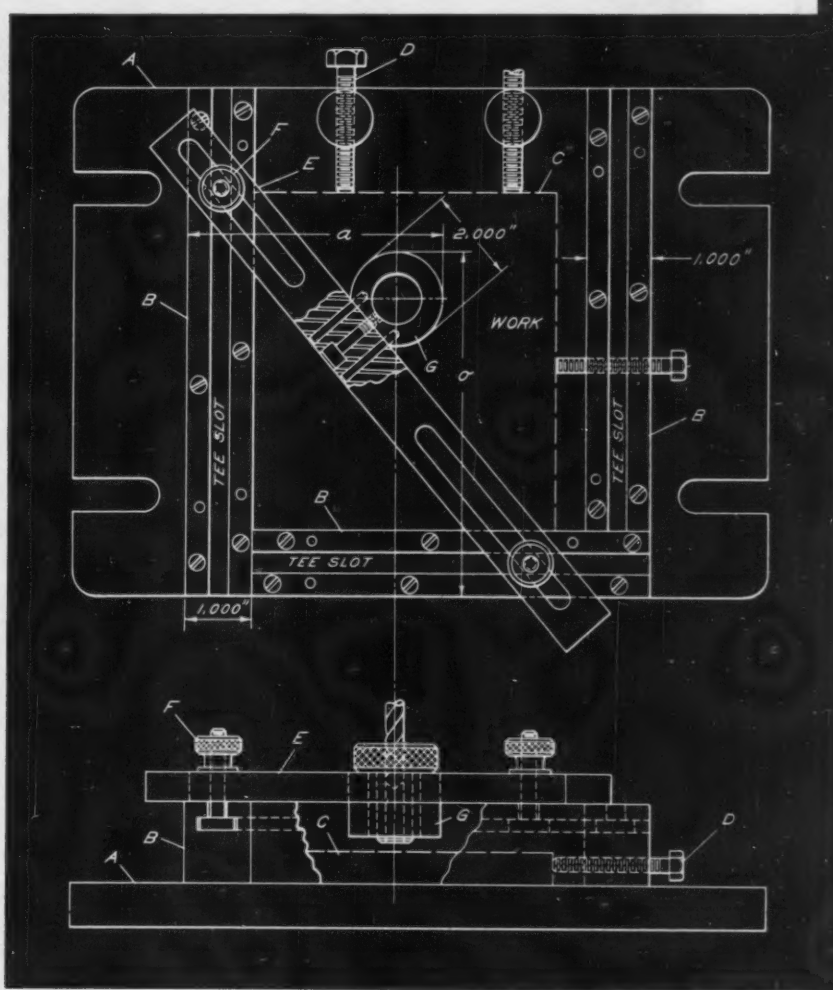
In principle, the device itself is a jig, the bushing of which has an adjustable location over the work area. A steel or cast-iron baseplate *A* is ground flat and mounted on the drill-press table. Three T-slot edge rails *B* are attached to the front and sides of the baseplate by dowel-pins and by cap-screws in recessed holes. The rails are exactly 1.000 inch wide, and their top surfaces are ground flat. The two reference surfaces of the work *C* bank against the front and left rails. Toe-dogs *D* secure the work in position.

A guide bar *E* rests across the rails, being clamped by the thumb-screws *F* of T-slot bolts in the rails. The bolts run through slots at each end of the bar. The slots provide for adjustment of its diagonal position from the front rail to either side rail.

Along the center of the bar, a cylindrical bushing block *G* is doweled and screwed. The block has an outside diameter of 2.000 inches, and is bored concentrically to receive liners in which standard drill and reamer slip bushings can be inserted.

Given the coordinates for any hole, it is a simple matter to locate the block correctly by first setting outside micrometers or vernier calipers to gage the distances *a* and *o*. These distances are each 2.000 inches greater than the respective abscissa and ordinate of the hole, the width of the rail and the radius of the block being included.

Other guide bars, fitted with blocks which will receive different sizes of liners, will increase the range of hole diameters that can be produced with the device. Or, a set of interchangeable blocks can be used with the same guide bar.



To locate the block (G), guide bar (E) is adjusted until both known distances (a) and (o) are obtained.

Indexing Fixture for Milling Square Ends on Studs

By W. M. HALLIDAY, Birkdale, Southport, England

An indexing type of milling fixture designed to grip four studs simultaneously for machining squared heads is shown in the illustration. One feature of this device is a single-lever locking arrangement for all four studs.

The fixture is mounted on a rectangular baseplate *A* provided with a cylindrical boss. Four bolt holes are drilled through the flanges of the plate for securing it to the machine table.

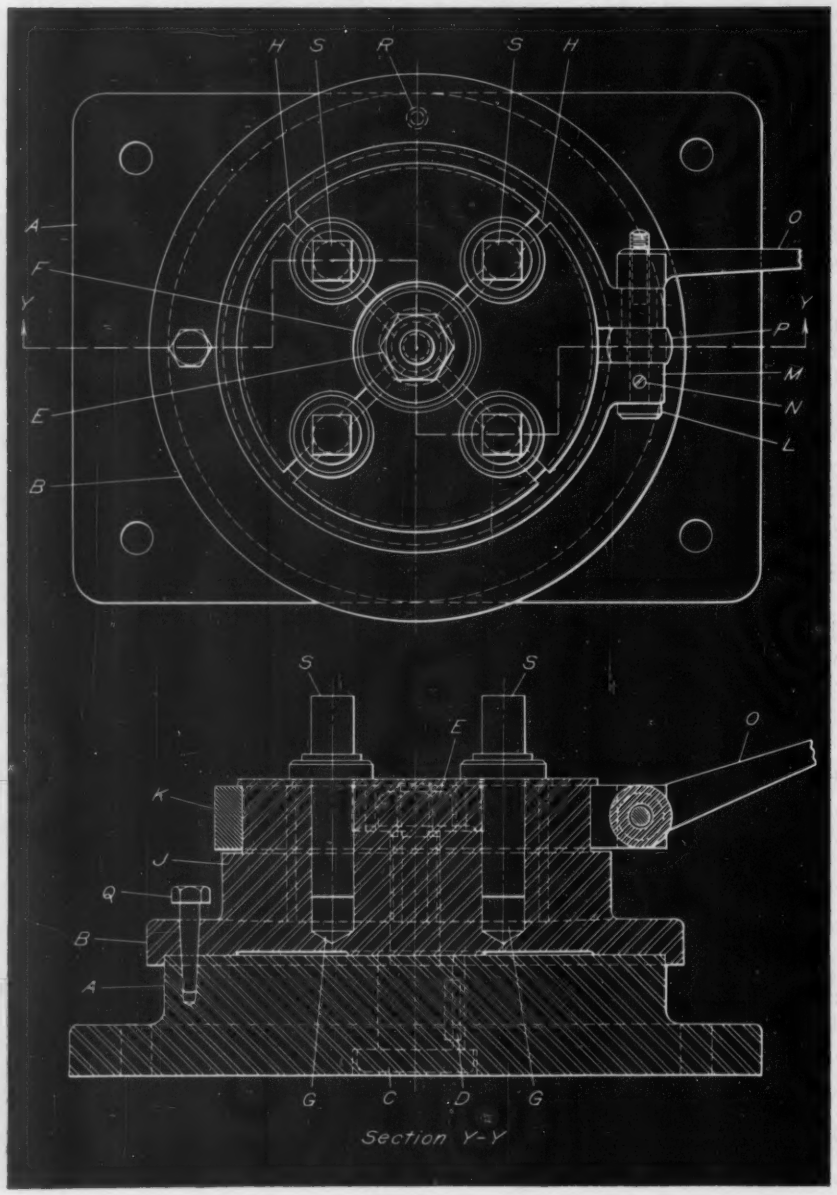
Circular table *B* has a shallow recess in the under side of its flange, bored to a running fit with the boss on the baseplate. The table is bored through the center to fit the small diameter of shouldered stud *C*. Key *D* restrains the stud from rotating within plate *A*. Hardened steel lock-nut *E*, together with a washer, is threaded on stud *C* within counterbore *F*, and serves to clamp the circular table in position.

Four blind holes *G* are drilled and reamed to fit the shanks of the studs. The holes are drilled deeper than the length of the studs so that their shoulders will bank against the top of the table. They are located at identical radial distances from the center of the table, and at equal chordal spacings to each other so as to form the corners of a square, as seen in the top view of the illustration.

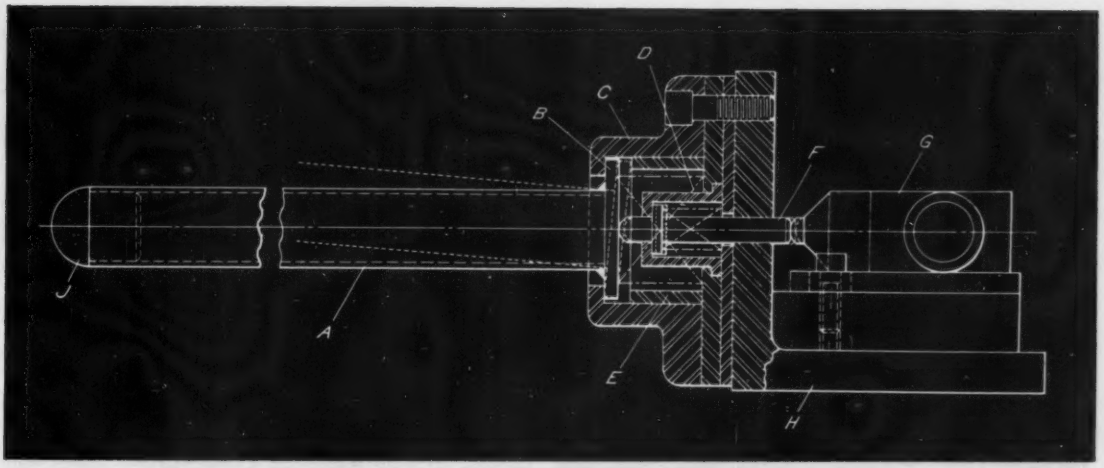
Two 3/16 - inch wide saw-cuts *H* are machined diagonally across table *B*, 90 degrees apart, passing through the center of each pair of holes. The slots are cut almost to the bottom of the four holes.

An annular groove *J* is cut on the periphery of table *B* to receive a split clamping ring *K*. The upper wall of the groove is reduced in diameter to enable the ring to be snapped into place.

The shank of stud *L* is a close fit within a hole bored through the front cheek *M* of the clamp ring, but passes through an elongated hole in the opposite cheek. A setscrew *N* in cheek *M* prevents the stud from turning. The ring is clamped by means of hand-lever *O*, which is threaded on the end of the stud. A hard rubber



Indexing type milling fixture with quick-acting locking arrangement which grips four parts simultaneously for machining ends.



Micro switch (G) operates when tubing (A) is tripped in any direction.

sleeve *P*, inserted between the cheeks of clamp *K*, is compressed when lever *O* is tightened. As the lever is backed off, the sleeve expands, thereby aiding the clamp in relieving pressure on the table segments.

Indexing of circular table *B* is accomplished by means of hardened steel taper pin *Q* which is situated in a tapered hole in the flange of table *B*. The pin fits into a matching tapered hole in the top of the baseplate. A second tapered hole *R* is provided in the baseplate, 90 degrees from the first, to receive the taper pin after the table has been indexed.

In operation, four studs *S* are placed in blind holes *G* with their shoulders flush with the top surface of the table. Hand-lever *O* is then moved clockwise, which draws the clamping ring together, thus compressing the split sections of the table and securing the work-pieces in position. The table is then rotated until taper pin *Q* engages one of the tapered indexing holes. Tightening lock-nut *E* will lock the table in position. Both the work-piece and the fixture are now ready for machining.

The milling machine is set up with a gang of four side cutters which is passed once across the stud ends to form a pair of parallel flats on each part. Taper pin *Q* is then withdrawn, lock-nut *E* backed off, and the table rotated 90 degrees until the taper pin engages the second hole *R*. After retightening the lock-nut, the fixture is again fed past the gang of cutters to mill the second pair of parallel flats on each stud, thus completing the square end.

When the hand-lever is loosened, sleeve *P* expands, forcing the clamping ring to open, which relieves the pressure on the split sections of the table. The studs may then be removed and the fixture reloaded for the next run.

Safety Device Operates from Any Direction

By F. C. Elmo, Dayton, Ohio

As a safety feature, it is often necessary to install a knee-or foot-actuated stop switch where parts are running through hand-loaded machinery. The illustration shows a compact and effective design for such a switch.

A length of thinwalled tubing *A* is brazed to a disc *B* that floats in a housing *C*. This disc is held in position in the neck end of the housing by the pressure of a spring *D*. When the operator's knee or foot trips the tubing, the disc is rocked against a spacer *E*, forcing a spring-loaded plunger *F* to the right. The opposite end of the plunger operates a micro switch *G* to stop the machine.

The device is readily constructed around a section of angle-iron *H*. Since the tubing can be tripped in any direction, there is no particular mounting problem. The end of the tubing is finished with a hard-wood knob *J*.

* * *

Elasticity of Various Metals

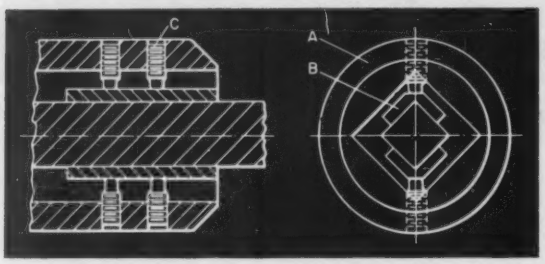
Magnesium has a modulus of elasticity of 6,500,000; aluminum, a modulus of 10,000,000; and steel, a modulus of 29,000,000. Stiffness increases in proportion to the cube of the depth of the section in the direction of bending. In equal section, magnesium has less stiffness than the other two metals. However, slight increases in section depth increase stiffness tremendously. If depth is increased to the point where the weights of the three metals are equal, the stiffness of magnesium is 8.19 times that of aluminum and 18.9 times that of steel.

Ideas for Shop and Drafting-Room

Adjustable Chuck Inserts Facilitate Centering Square Work-Piece

By Paul Grodzinski, London, England

A square work-piece was held for machining by means of cylindrical inserts located within a collet type chuck. The work had to be removed for checking several times during the course of



Work-holder containing adjustable inserts aids in centering square work-piece.

the operation, but each time the part was re-chucked it was found to be located slightly off center.

This situation was remedied by the use of adjustable angular inserts, as shown in the illustration. A special work-holder *A* was broached to accommodate a work-piece of square cross-section. After broaching, four set-screw holes were drilled and tapped so that they would break through two corners of the square hole and be located diagonally opposite each other.

The work is retained by two L-shaped inserts *B*, and may be centered by adjusting set-screws *C*. Although both inserts may require adjusting each time a new work-piece is gripped, the intermediate removal of any individual part necessitates loosening the set-screws on one side only. In this way, centralization of the work is maintained throughout the operation.

Tool Bit Quickly Machined for Cutting Special Thread Forms

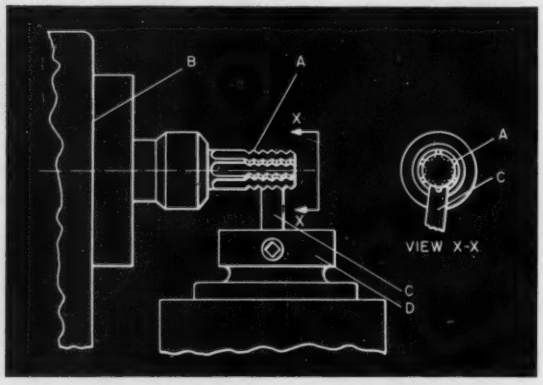
By George Spasink, Claremont, N. H.

Producing special taps or thread sizing tools is a problem faced by many tool-rooms. It usually entails the grinding of an intricate thread form on a tool bit so that the bit, in turn, may be used to produce the tap required.

A typical situation arose during the production of male and female members requiring special mating threads. A multiple cutter was obtained for milling the external threads; so only a tap was needed to cut the internal threads. This is how it was done.

The straight-shank multiple cutter *A* was mounted on the spindle of a horizontal milling machine *B*, as shown in the illustration. A high-speed steel tool bit *C* was first annealed and then secured in a vise *D* in a tilted position so as to obtain the desired clearance angle. The table, with the vise mounted on it, was fed past the rotating cutter. In this way, the exact thread form was cut into the tool bit.

The thread form may be similarly taken from a tap. To do this, the tap should be mounted between lathe centers and used as the cutting tool. An annealed high-speed steel tool bit is placed in the tool post. After setting the lathe for the



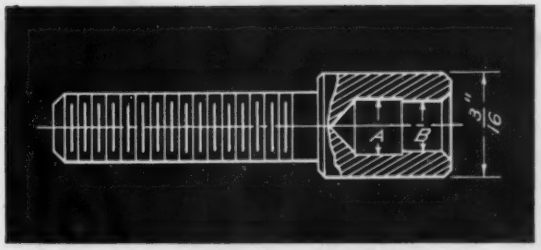
Multiple thread-milling cutter is used to machine accurate thread form in the end of annealed tool bit.

proper lead, the bit is fed along the tap. Necessary clearance may be obtained by raising the tool bit above the longitudinal center line of the lathe spindle.

Unevenly Ground Drill Facilitated Step-Drilling Job

By Donald Baker, Boonton, N. J.

The design of the brass spring chuck illustrated (gripping slots not shown) is such that the drilling of a blind stepped hole is required. Ordinarily this would present no problem, but, as may be seen in the diagram, the larger diameter *A* of the stepped hole is at the inner end.



Difficult step-drilling job accomplished by using an unevenly ground drill

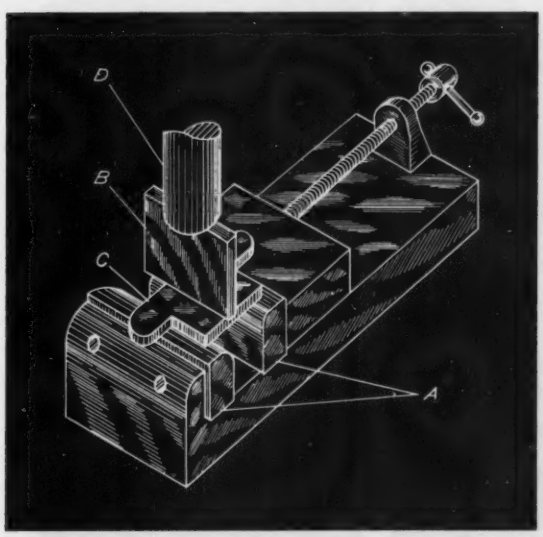
Although this diameter is only a few thousandths of an inch larger than diameter *B*, its location and the small size of the part combine to present a rather unusual production problem.

The stepped holes were successfully produced, however, in the following manner. First, a drill of the correct diameter was fed in half the total depth of the hole. Following this, another drill of the same diameter as the first, but whose cutting lips were ground unevenly, was fed to the full hole depth, cutting the inner portion of the hole to diameter *A*. The fluted portion of the drill used for diameter *A* should be relieved up to a point close to the cutting end in order to prevent enlarging diameter *B*.

Vise Substitutes as Bending Die

By M. G. BARKER, Alhambra, Calif.

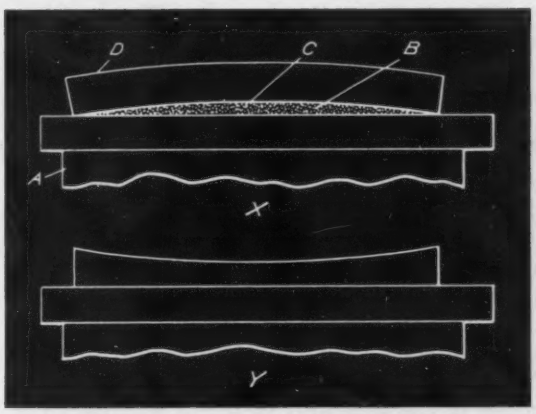
A variety of small channel bends may be made at a modest tool cost by employing a modified plain or flanged vise. For such an application, the vise can be fitted with a pair of jaws *A*, as shown in the illustration, that are rounded on their top inner edges. A piece of flat steel *B* of desired thickness serves as the punch.



Plain vise equipped with special jaws for use as a low-cost bending die

In use, the jaws are suitably spaced and the work-piece *C* laid across them. The part may be positioned with either a scale or a locating strip. Ram *D* of an arbor press forces the punch into the work to form the bend.

When holes are required at the base of the channel, they are first drilled or pierced, then fitted over locating pins in the punch blade. The use of a spacer block between the jaws will insure duplicate parts.



A layer of powdered plaster of Paris, or similar material, supports the bowed section of a distorted work-piece on a magnetic chuck.

Holding Thin Distorted Parts on a Magnetic Chuck

By RICHARD M. WEBER, San Francisco, Calif.

Grinding thin, ferrous work-pieces that have been distorted, due to either a heat-treating operation or some other cause, usually poses a problem with regard to clamping. This difficulty may be overcome as shown, in an exaggerated case, at X in the accompanying illustration.

A magnetic chuck *A* is employed as the work-holding device. A layer of powder *B*—in some form such as plaster of Paris, prepared chalk, or talc—should be sprinkled liberally over the surface of the chuck. The work-piece is then placed on the chuck with its concave face *C* facing down as shown, and slid along the chuck face at right angles to the direction of the bend. The powder will support the work in a relaxed position during the grinding of upper work surface *D*.

After this operation is completed, the chuck is de-energized and the work-piece and powder removed. The work is then replaced in an inverted position, as shown at Y, and the chuck re-energized. Since the part has been under no strain, it will remain flat when released.

Plans for Show Receive Attention

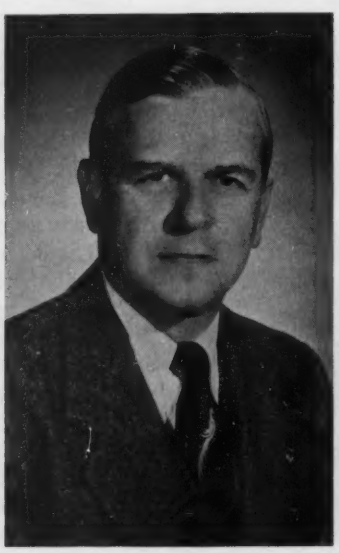
THE Machine Tool Show, which will be held in Chicago September 6 to 17, inclusive, was foremost in the minds of members attending the fifty-third annual meeting of the National Machine Tool Builders' Association. The four-day meeting was held at the Greenbrier Hotel, White Sulphur Springs, W. Va., beginning November 17.

In his opening address, Herbert L. Tigges, president of the Association and executive vice-president of Baker Brothers, Inc., Toledo, Ohio, reviewed the machine tool situation from the standpoint of possible future defense requirements and discussed the type of organization necessary in Washington to deal with the problem of machine tools in the event of another national emergency. He then emphasized the necessity of preparedness in the metal-working plants throughout the country and the importance of modernizing production facilities. Mr. Tigges finally stressed the point that at the coming Machine Tool Show there will be on display under one roof the equipment that helps to keep America's economy stable, maintain advancements in the standards of living, and keep our country properly prepared against an attack by a foreign power.

Joseph T. Vinbury, chairman of the Committee on Advertising and advertising manager of the New Britain Machine Co., New Britain, Conn., in his paper "Protect Your Investment—Advertise the Show" made a number of practical suggestions as to how each exhibitor could derive maximum benefits from participation in the Show. He mentioned that advertising ahead of time and plenty of well-prepared descriptive literature on hand for distribution at the Show were just as essential to successful selling as top-notch appearance and performance of the machines to be exhibited.

William E. Rutz, chairman of the Machine Tool Show Committee and executive vice-president of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., pointed out in his paper "The World's Best Investment in Action" that the International Amphitheatre, together with the Industrial Exhibition Hall or Annex where the Show will be held in Chicago, provides the best facilities available in the United States for such an exposition. There will be 266,000 square feet of net booth area, although this is considerably less than what exhibitors would like to have.

Arrangements have been made for convenient transportation between the Show, Loop hotels, and the Navy Pier. Parking facilities, food services, and a system of fast registration were also discussed by Mr. Rutz. He completed his talk by pointing out that the Show will give the visitor "the greatest opportunity ever afforded him to consider the replacement of obsolete machines with new models, learn advanced methods in production, and obtain suggestions for savings,



Newly elected officers of the National Machine Tool Builders' Association are (left to right) Milburn A. Hollengreen, president; Louis Polk, first vice-president; and Jerome A. Raterman, second vice-president and a director.

at Machine Tool Builders' Meeting

which are all necessary to maintain a competitive position."

The importance of public relations to the machine tool industry and also to the Show was the subject of an inspiring address by Alfred V. Bodine, chairman of the Public Relations Committee and president of the Bodine Corporation, Bridgeport, Conn. Tell Berna, general manager of the Association, in his annual report predicted an increase in the drive for sales after the Show is over and emphasized the need for publicizing the event to attract the right kind of visitors.

Richard W. Banfield, chairman of the Subcommittee on Tax Policy and executive vice-president of Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford, Conn., outlined the activities of his committee in a paper entitled "The New Tax Outlook," and explained in detail the liberalized depreciation allowances in the 1954 Internal Revenue Code and other provisions of the Code of interest to both corporations and individuals.

A report on the Washington scene was made by Graham E. Marx, Director, Metal-working Equipment Division, Business and Defense Services Administration, Washington, D. C.; and production capacity for defense was covered by Ralph S. Howe, chairman of the sub-committee on Permanent Defense Capacity and president of the New Britain Machine Co. Procurement progress was the subject of a talk given by Charles S. Davis, Jr., chairman of the Subcommittee on Procurement Policy and vice-president of the Lake Erie Engineering Corporation, Buffalo, N. Y.

Foreign affairs were dealt with by Ralph J. Kraut, chairman of the Sub-committee on Foreign Affairs and president of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., while T. Laurence Strimple, chairman of the Sub-committee on Renegotiation and secretary and assistant treasurer of the National Acme Co., Cleveland, Ohio, considered continued renegotiation problems. The speaker at the banquet was George E. Sokolsky, whose topic was "These Puzzling Days."

Milburn A. Hollengreen, president and general manager of the Landis Tool Co., Waynesboro, Pa., was elected president of the Association for the coming year; Louis Polk, president of the Sheffield Corporation, Dayton, Ohio, was elected vice-president; Jerome A. Raterman, president of the Monarch Machine Tool Co., Sidney, Ohio, was elected second vice-president and a director; and John C. Cotner, president and general manager of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, was re-elected treasurer.

The new directors elected, in addition to Mr. Raterman, were Henry D. Sharpe, Jr., president of Brown & Sharpe Mfg. Co., Providence, R. I.; and Perrin G. March, III, president of the Cincinnati Shaper Co., Cincinnati, Ohio.

John C. Cotner (left), re-elected treasurer of the National Machine Tool Builders' Association; and Henry D. Sharpe, Jr., and Perrin G. March, III (center and right), who were elected directors at the meeting

Talking with Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Crystallizing the Sales Manager's Duties

THE work of the average sales manager responsible for the marketing of industrial equipment gets more complex and demanding year by year. Market opportunities are expanding. New and improved products are becoming available. Better sales methods are being devised. Altering conditions such as these continually present a series of new challenges.

That the best salesman will necessarily be the best sales manager is an antiquated idea. Today, management skill must come first, and an understanding of organized and personalized selling, a close second. Most sales managers have a good over-all conception of their jobs, but relatively few pay sufficient attention to seeing that every responsibility and every duty are carefully analyzed and thoroughly evaluated, and that each one receives the attention it relatively deserves.

The principal responsibility of any sales manager to his company is to produce profitable and satisfactory business, at a rate and in a volume necessary for its success. After dividing this over-all responsibility into its various parts by setting down a check-list of duties, there comes the immediate problem of devising a means of measuring performance. Check-lists of performance are all the rage today. They can be made very useful, but only if each item is analyzed and applied to the individual job. Many sales managers, in establishing a check-list, find that some important duty has been neglected or has even escaped attention.

A typical check-list could be as follows:

1. *Plans*—Do we plan our organization and operations to meet both short- and long-term needs based on the wisest estimates that we can make?

2. *Areas and Customers*—Do we progressively study our present and future markets to serve as a directional guide in maintaining and advancing our company's position?

3. *Policies*—Do we adopt carefully thought-out policies that mark every course of procedure, and define them clearly so that all can follow?

4. *Sales Methods*—Are we alert to the best methods of selling our products nationally and locally, whether through direct or resale channels?

5. *Organization*—Do we match the right man to the right job in such a way as to have an efficient team ready to meet the demands of our present and future markets, as well as our own product plans?

6. *Responsibilities*—Do we define and assign responsibilities and duties to others, or do we dip in and try to carry the flag ourselves?

7. *Leadership*—Do we lead the group through an earned respect and devotion, or do we try to hold our job by the authority invested in it?

8. *Sales Tools*—Do we supply every sales engineer with the best tools to work with, and every prospect with a means of buying our products easily?

9. *Manpower*—Do we select, train, and constantly develop men, realizing that our strength depends entirely on the strength of the team?

10. *Records*—Are our records simple and straight, remembering that elaborate records never make sales but that correct records are absolutely necessary?

11. *Rewards*—Do we adequately reward sales engineers for their performance? Do we provide a certain security of position? Do we provide incentives for extra effort?

12. *Departmental Cooperation*—Are we alert to gaining the enthusiastic help of our company's departments other than sales, since every sales manager's job includes selling "inside" as well as "outside"?

13. *Product Ideas*—Do we only sell what our company provides, or do we give customers new ideas about improved products and methods?

From a close study of each item named, the live sales manager can find that there are undoubtedly some weak points in the performance of his duties. Strong, active sales managers are always alert to improvement. They have a pleasant cooperative approach, and also an inquiring and imaginative mind. They are long at planning, coordinating, and encouraging, and short on trying to do the selling job themselves.

* * *

Titanium Centrifugally Cast

Successful production of what are claimed to be the first true centrifugal castings of titanium has been achieved as the result of metallurgical research at the Armour Research Foundation of the Illinois Institute of Technology, Chicago, Ill. A number of sound castings, weighing from 3.3 to 9 pounds, have been poured. Casting equipment and techniques were designed or supervised by the Wisconsin Centrifugal Foundry, Inc., Waukesha, Wis.

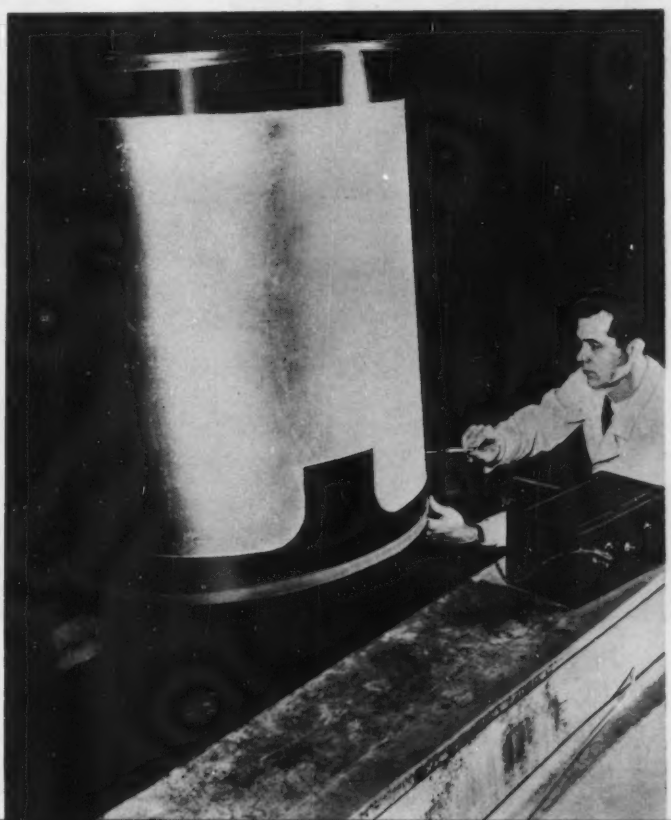
Development of this process opens a new field for the use of titanium castings as components in areas where salt-water corrosion is a major problem. Other uses might be as anticorrosion rings for carrier-based aircraft, and, since they have the advantage of a high strength-to-weight ratio, for certain jet-engine parts.

Chemical "Milling" Permits Accurate Sculpturing of Formed Parts

"Chem-Mill" is a revolutionary new process for precision forming metal parts from aluminum sheets and forging stock by immersion in chemical solutions. The process was originated by North American Aviation, Inc., Los Angeles, Calif., and developed in conjunction with Turco Products, Inc., also of Los Angeles. By agreement with North American, Turco is licensed to make the process (on which patents are pending) available to other companies.

Parts emerge from the chemical bath smooth and perfectly formed. Equipment costs are low and facilities can be quickly installed. Also, the process is ideal for the mass production of parts, since many components of various sizes and shapes can be processed simultaneously, the number being limited only by the size of tanks.

Perhaps the greatest advantage afforded by use of the Chem-Mill process is that it can be used to produce precision contouring of forgings or intricately shaped and curved aluminum sheets. This permits the use of the process for re-dimensioning parts to closer tolerances. The process permits the holding of close tolerances on almost any desired complexity of design; and permits tapering, curving, and other intricate shaping, often impractical with ordinary equipment. While Chem-Mill is being confined at present to aluminum alloys, its application to other metals is being developed.



Excess metal is removed from an aircraft part by chemical "milling." Micrometer is shown being placed on "milled" section of a curved skin.

LATEST DEVELOPMENTS IN *Shop*

Cincinnati Toolmaster Milling Machine

A milling machine designed for use in tool-rooms, repair depots, tool and die shops, pattern shops, contract machine shops, and other metal-working shops has been announced by the Cincinnati Milling Machine Co., Cincinnati, Ohio. This machine, known as the "Toolmaster," is available in three styles: 1A, with manual feed to the quill; 1B, having a power feed to the quill; and 1C, equipped with a heavy-duty head. The table of this machine has a longitudinal traverse of 16 inches, a cross traverse of 10 inches, and a vertical movement of 17 inches.

The over-arm of the machine is mounted in dovetail ways in the turret unit. This construction permits the operator to swivel and position the over-arm so that the entire area of the table is within the machining range of the spindle head. A square gibbed saddle-knee bearing, patterned after that of the larger Cincinnati milling machines, provides the ruggedness required for accurate work.

The knee bearing on the column is a departure from conventional design. Instead of a "wrap around" bearing surface on the dovetail guide, the knee takes its bearing in the two V-surfaces formed between the dovetail guide and column face. This construction offers several times more resistance to deflection than the dovetail

Fig. 1. Cincinnati Toolmaster milling machine with heavy-duty spindle head

Fig. 2. Toolmaster milling machine equipped with power feed to the quill

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

guide alone. The table feed-screw has an anti-backlash device consisting of a double-nut arrangement, which permits adjustments to be made by loosening two screws.

Motors for the 1A and 1B machines are of the "pancake" type, integral with the spindle head. There are eight spindle speeds, selected by changing one or two belts. Three ranges are available: 108 to 2825, 140 to 3800, or 215 to 5650 R.P.M. Machines having the low range are powered by a 3/4-H.P. motor, while machines within the medium and high ranges are powered by a 1-H.P. motor.

A high degree of operating convenience is attained for these machines. Clamps for the table, saddle, and knee are lever-operated. Saddle and knee clamping levers can be repositioned as desired. Micrometer dials are extra large, with widely spaced, legible graduations. Each end of the table is equipped with a traverse feed handwheel. The spindle head can be swiveled right or left for taking cuts at any angle up to 90 degrees.

The Nos. 1A and 1B machines are equipped with a built-in micrometer quill stop for depth adjustment when the quill is fed downward. A lever-operated quill clamp is located at the front of the spindle head. Angular positioning of the spindle head is accomplished through a worm and worm-wheel arrangement having a crank extension at the side of the over-arm. The spindle nose is of the collet chuck type and receives standard collets ranging from 1/8 to 1 inch in diameter.

The No. 1B Toolmaster, Fig. 2, is identical to the No. 1A except for the addition of power feed to the quill. A two-position feed-engaging knob extends from the front of the head. Feeds are 0.002 or 0.006 inch per revolution of the spindle.

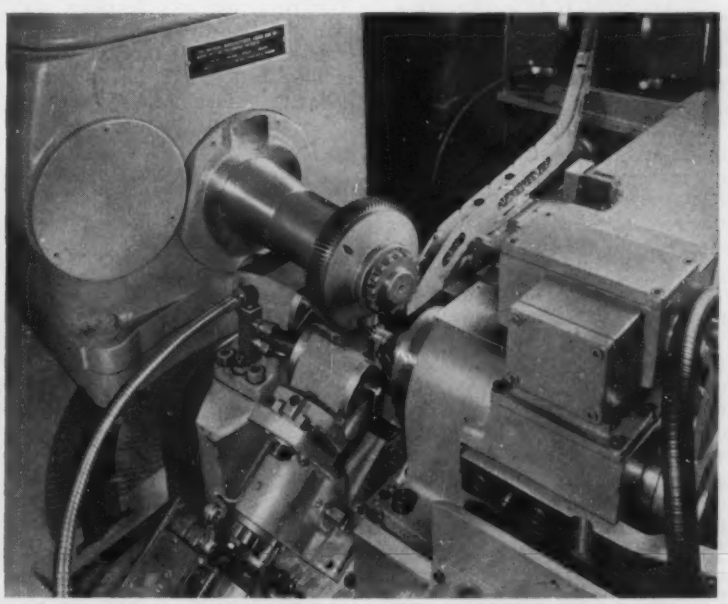
The No. 1C Toolmaster, Fig. 1, is equipped with a motor-driven over-arm unit. A "can" type 2-H.P. motor drives the spindle through a gear train. Eight spindle speeds are available, ranging from 100 to 1530 R.P.M. The spindle head can be swiveled to the right and left, as in the other models. An intermediate unit may be added to provide swivel adjustment at a right angle to the table T-slots.

Several attachments are available for these machines, including a self-contained, motor-driven shaping attachment which can be mounted on the over-arm. The turret of the shaping attachment is so designed that it can be allowed to remain on the over-arm.

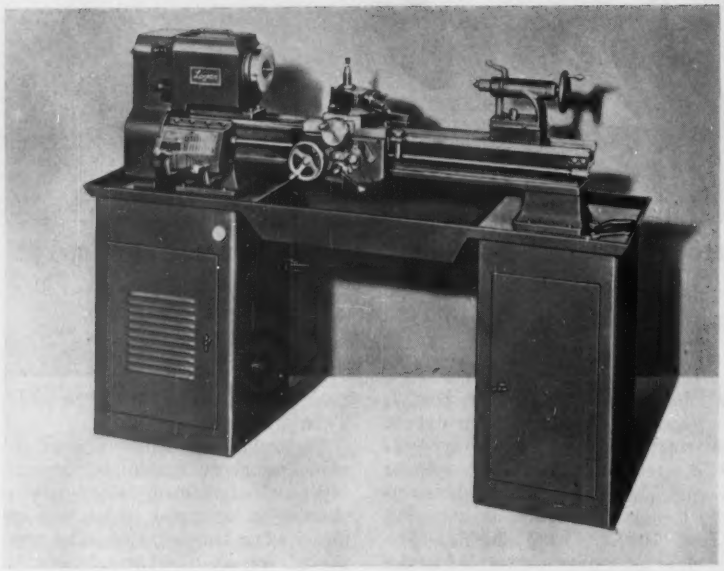
Circle Item 101 on postcard, page 255

Fellows Automatic Machine Designed to Chamfer as Well as Shave Teeth

Accurate chamfering of the tips of automotive pinion teeth at the same time the teeth are being shaved is accomplished by a process developed by the Fellows Gear Shaper Co., Springfield, Vt. The basic machine equipped for this work is a Fellows No. 8 "Full-tool" gear shaving machine tooled up for fully automatic operation. Two tools are employed—a shaving tool and a rotary serrated-tooth chamfering tool. The latter is located on a movable slide below and at the left of the former. An air cylinder automatically advances and



Close-up view of shaving and chamfering tools on Fellows "Full-tool" gear shaving machine tooled up for fully automatic operation



Logan 12-inch swing lathe of new "2500" line

withdraws the chamfering tool slide in timed relationship with the shaving cycle.

In production, the pinions roll down a chute from an automatic feeding device and drop, one at a time, into a carrier. An air cylinder moves the carrier to the position where the pinion is loaded on the work-arbor. When this point is reached, a micro switch operates another air cylinder, bringing the work-arbor forward through the hole in the pinion to locate and clamp it for shaving and chamfering. The carrier is then drawn back to receive the next pinion.

As soon as the carrier is back in its starting position, the shaving tool starts to rotate; the depth feed-cam on the machine raises the pinion to the previously set center distance for shaving; and the chamfering tool slide is advanced to bring this tool to its pre-set distance from the work.

After the first pass of the shaving tool across the pinion, the chamfering tool is withdrawn from the work and the direction of the shaving tool rotation is reversed for the second pass. As soon as this pass is completed, a recess in the depth feed-cam allows the pinion to drop slightly from the shaving center distance, the arbor is withdrawn, and the pinion is ejected into the unloading chute. Another pinion is then loaded and the cycle repeated.

Circle Item 102 on postcard, page 255

Logan 12-Inch Lathes

A "2500" line of 12-inch swing lathes is now being built by the Logan Engineering Co., Chicago, Ill. Extra strength has been given to these lathes through the provision of wider gears, larger shafts, heavier bearing supports, a heavier base, and the addition of weight at other points. The line consists of eight lathes—four turret and four screw-cutting models. The principal specifications are: swing over bed, 12 inches; swing over saddle, 7 1/4 inches; size of spindle hole, 1 3/8 inches; collet capacity, 1 inch; and distance between centers, 23 or 35 inches. Variable-speed drive or standard double V-belt drive is optional.

The cabinets have a large chip capacity, drop center pan, and three handy storage compartments. The special alloy spindle turns on a double row of oversize ball bearings. No bearing adjustment is needed.

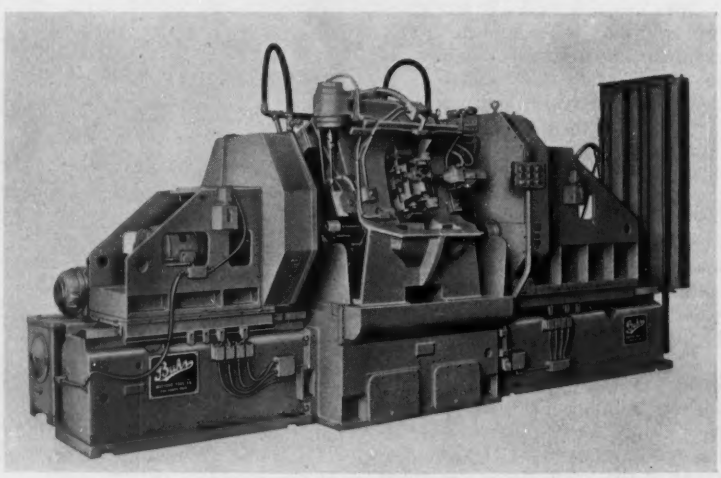
Circle Item 103 on postcard, page 255

Buhr Special Machine for Processing Hydraulic-Power Steering-Gear Housings

Milling, rough-boring and semi-finish-boring, facing, drilling, and individual lead-screw tapping operations on ninety-six hydraulic-power steering-gear housings per hour are accomplished on a special machine built by the Buhr Machine Tool Co., Ann Arbor, Mich. This two-way six-station trunnion type machine with hydraulic feed has single-place fixtures that are automatically clamped by a power wrench with torque control. Cluster heads, carrying bushing plates which register with fixtures at each station, are incorporated in a master gear-box.

All parts of this machine are completely interchangeable, and each component assembly is located by precision fitted dowels. Tapping spindles of the lead-screw type have precision-ground and chromium-plated threads. The automatic indexing mechanism of the cam-and-roller type is electrically controlled to insure uniform acceleration and deceleration of the indexing movements.

Circle Item 104 on postcard, page 255



Special machine for processing hydraulic-power steering-gear housings built by the Buhr Machine Tool Co.

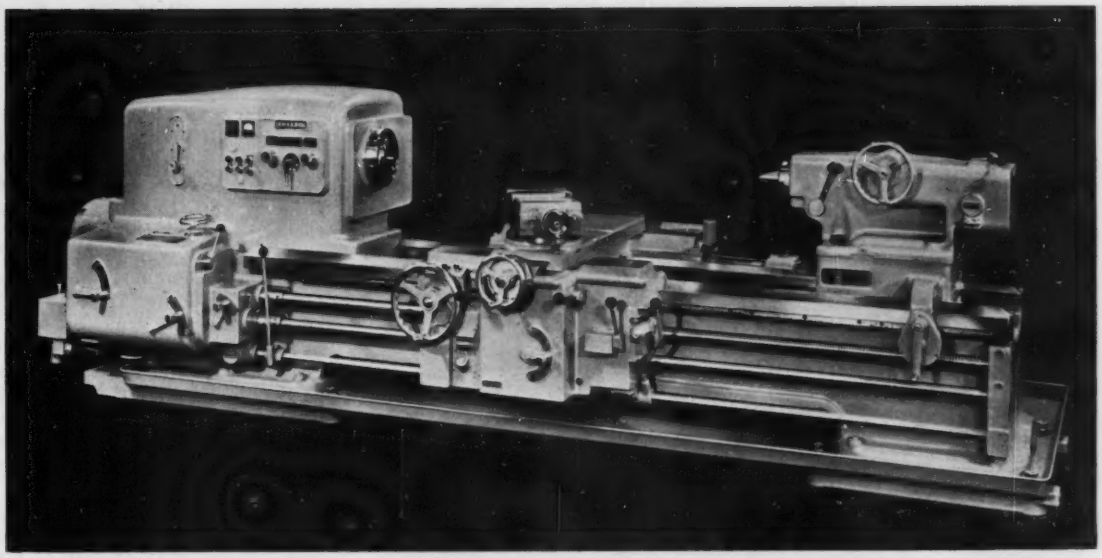


Fig. 1. Series 90 Dyna-Shift lathe has been introduced by the Monarch Machine Tool Co.

Monarch Dyna-Shift Lathes

A line of heavy-duty lathes developed specifically to permit carbide tooling to be used to full advantage on work of considerable size has been brought out by the Monarch Machine Tool Co., Sidney, Ohio. The machines, identified as the Series 90, have a 60-H.P. drive and are available in three models, having clearance diameters of 40, 44 and 48 inches.

The outstanding feature is the Dyna-Shift headstock which calculates and sets up spindle speeds. All an operator has to do is to set two dials—one for desired surface speed and the other for the diameter to be turned. Headstock gears are shifted hydraulically to give the appropriate spindle speed. On the headstock is a three-position shift control lever—free, run, and shift. All spindle speeds changes are made with the control lever on the headstock in the shift position. A safety mechanism prevents any actual shifting until the gear train is stopped. In the free position, the spindle may be rotated by a slight hand pressure. Dual levers on the headstock and apron control spindle rotation. These levers have run, brake, and jog positions. Thirty-six spindle speeds are provided, in a range from 6 to 750 R.P.M.

All electrical controls are grouped at the front of the headstock. In addition, a meter indicates the horsepower being consumed by the main-drive motor, so that the operator is aware of the reserve power available for an increase in feed or depth of cut. A high-pressure mist system lubricates all headstock gears and bearings. An individual motor-driven traverse gives the carriage rapid travel in both directions. The traverse unit is hung from the rear of the carriage and controlled from the apron by push-buttons. An inching feature permits the carriage to be positioned closely.

The bed is made of chromium-alloy cast iron. Ways are hardened

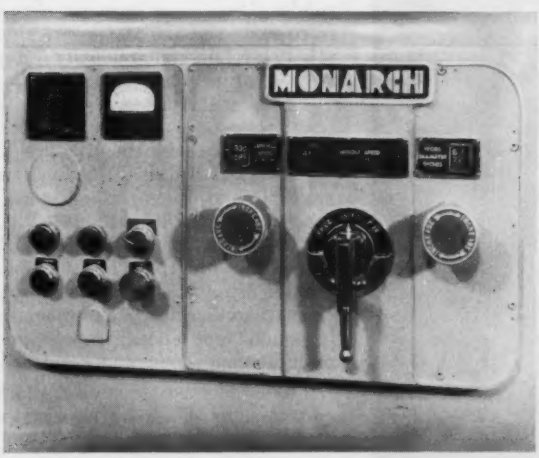


Fig. 2. Headstock of Dyna-Shift features automatic spindle speed calculation and change

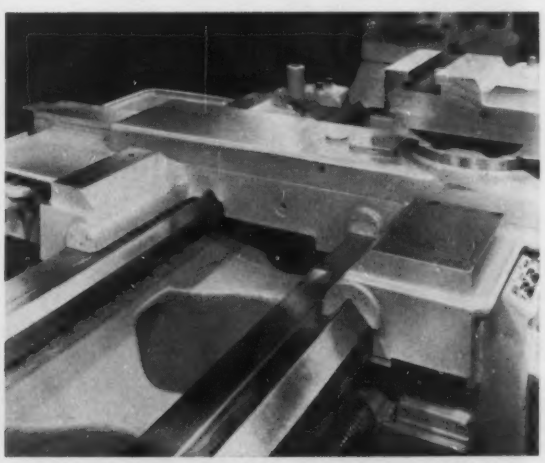
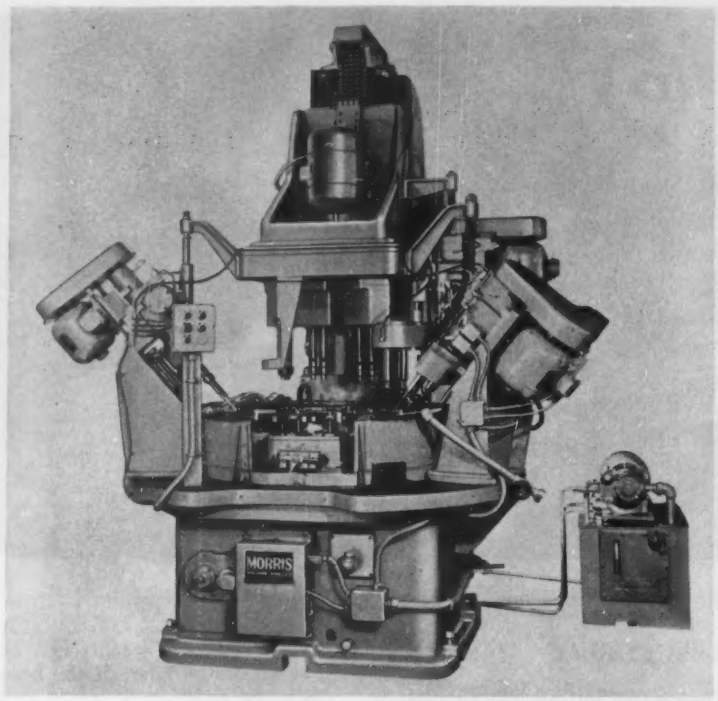


Fig. 3. Carriage of the Dyna-Shift lathe has push-button operated power traverse



"Mor-Speed" special transfer machine for processing carburetor parts

to a minimum depth of 1/8 inch, and ground to a tolerance of 0.001 inch in over-all length. The tailstock spindle is provided with two speed ranges.

Two coolant pumps are used. A primary pump mounted on the outside of the oil-pan at the rear of the machine supplies coolant to a trough. Final delivery of the coolant to the work is accomplished by a secondary pump at the rear of the carriage.

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"Mor-Speed" Machine for Processing Four-Barrel Carburetor Parts

A "Mor-Speed" special production machine that performs twenty-five operations on each body of a four-barrel carburetor at the rate of 375 pieces per hour has been built by the Morris Machine Tool Co., Cincinnati, Ohio. Operation is completely automatic except for loading, transferring, and unloading the work. Since the left and right sides of the carburetor body are identical, they are machined by the same tools. A transfer operation indexes the part 180 degrees to bring first one side and then the other into the machining position.

The machine has an indexing table 36 inches in diameter which stops automatically at each of six stations. The tool-spindles are carried in a master head with two four-spindle clusters and on a radially mounted drilling units around the outside of the table. Multiple-spindle tapping heads can be provided which use a single standard lead-screw to which the individual spindles are geared.

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Kearney & Trecker Milling Machines

A line of Model CE milling machines designed to combine quality with low initial cost has been announced by the Kearney & Trecker Corporation, Milwaukee, Wis. These machines are the result of a comprehensive survey of production facilities, tooling requirements, and vocational education needs. They have been developed to provide the range, power, simplicity, and precision usually found only in higher-priced machines.

These machines are made in both plain and universal styles. They are available in either a 3- or 7 1/2-H.P. size. Both sizes have sixteen quick-change speeds ranging from 25 to 1300 R.P.M. and feeds of from 1/2 inch to 25 inches per minute. The machines are ideally suited for a wide variety of applications, but especially in small tool shops, repair and maintenance shops, and vocational training schools.

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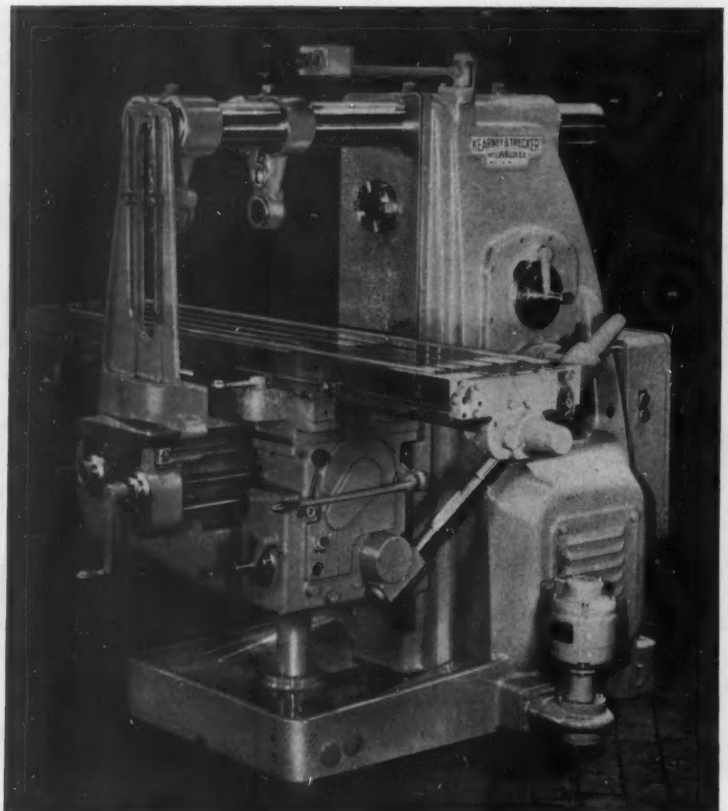

Kearney & Trecker Model CE plain milling machine

Gallmeyer & Livingston Universal Cylindrical and Internal Grinder

The No. 1230 universal cylindrical and internal grinding machine placed on the market by the Gallmeyer & Livingston Co., Grand Rapids, Mich., is designed primarily for plants having a wide variety of external and internal grinding work, but not enough of any one kind to justify specialized machines. This precision machine is built to take heavy roughing cuts as well as to produce an extremely fine finish.

The tailstock unit has a lever-operated adjustable spring pressure center and center lock. A steadyrest is provided to support relatively long, small-diameter work between centers to prevent bowing due to wheel pressure. This steadyrest will handle work up to 3 inches in diameter. A special steadyrest unit can be obtained for work up to 5 inches in diameter.

A table-mounted dressing unit is available for radius-dressing external grinding wheels at work-center height. This unit will dress wheels having a maximum convex radius of 1 inch or a maximum concave radius of 1 1/4 inches. A wheel-balancing arbor and a balancing stand for external wheel mounts are standard equipment.

The hydraulically operated machine table has an infinite number of speeds from 3 inches per minute up to 50 feet per minute, and the work-head has an infinitely variable range of speeds from 0 to 400 R.P.M. The table is 6 inches wide, 50 inches long, and has a hand- or power-operated travel of 32 inches. Taper graduations range up to 3 inches per foot on the diameter. Table traverse by handwheel is available at two rates—1/2 inch and 3 inches per turn.

The work-head can be swiveled 360 degrees, and can be operated at speeds ranging from 0 to 400 R.P.M. Work up to 12 inches in diameter by 30 inches will swing over the table using a grinding wheel 14 by 5 inches. The two spindle speeds regularly available for external grinding are 1750 and 2100 R.P.M.

For internal grinding, the maximum distance from spindle axis to work axis is 7 inches. The spindle speed for internal grinding is 24,000 R.P.M. with the regular drive, but quills operating at 12,500, 16,000 or 35,000 R.P.M. can be had.

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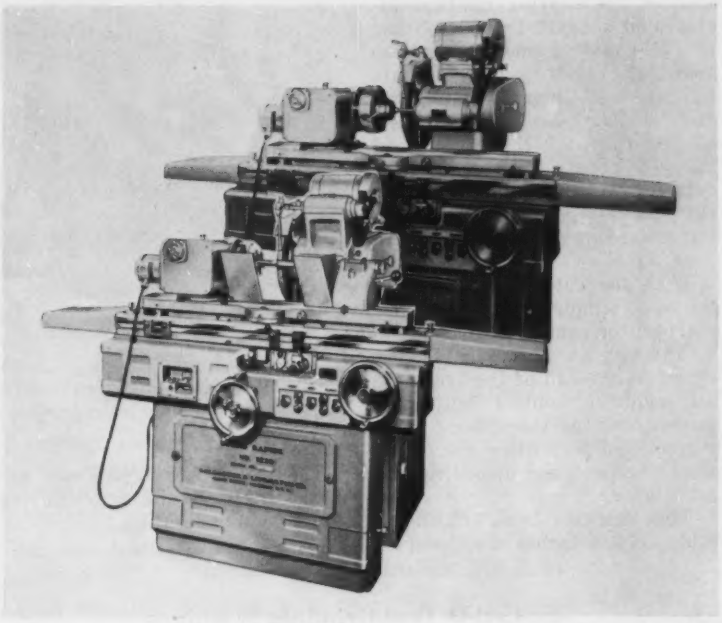
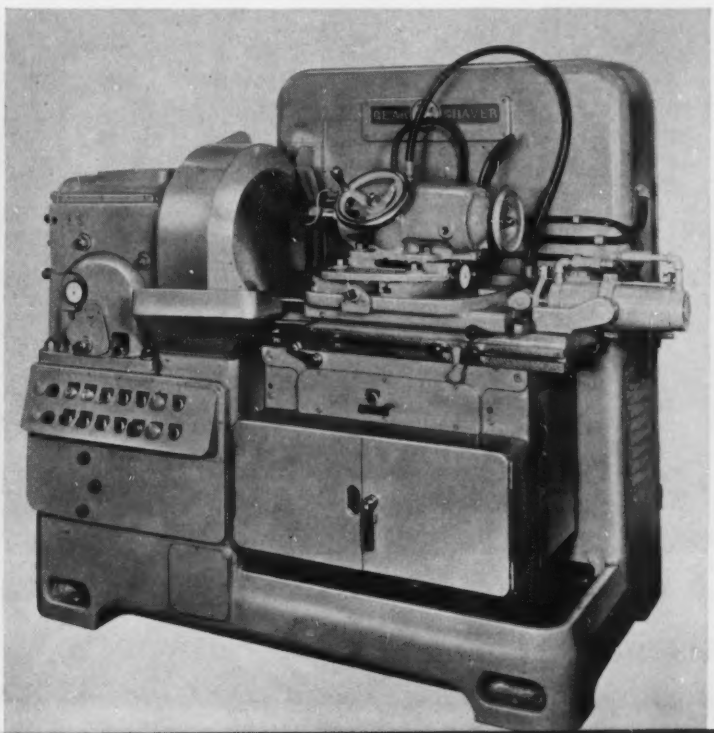


(Top) Universal internal-external grinder built by Gallmeyer & Livingston Co., set up for internal grinding. (Bottom) A machine set up for external grinding

Improved Red Ring Internal Gear Shaving Machine

An improved Model GCR Red Ring internal gear shaving machine featuring air cylinder and handwheel controls, developed to speed up gear loading and unloading functions and reduce operator fatigue, is now available from the National Broach & Machine Co., Detroit, Mich. This machine performs precision shaving operations on internal spur and helical gears from 3 to 12 inches pitch diameter having up to 4 diametral pitch teeth.

A new cutter-head and slide de-



Improved Red Ring internal gear shaving machine

sign on the shaving machine includes an air cylinder control that provides fast advance and retraction of the cutter-head to facilitate loading and unloading of gears from the work-head. A handwheel at the front of the cutter-head allows the operator to advance the cutter with one hand while, with the other, simultaneously guiding the cutter into mesh with the work gear.

With the cutter in mesh with the work, simply pressing the cycle start-button causes the machine to go through an automatic shaving cycle. At the end of the cycle, the air cylinder control button is pushed, causing the cutter-slide to retract and permitting the operator to unclamp and unload the finished gear.

This machine is 62 1/2 inches wide, 39 3/4 inches deep, and 64 inches high. A hinged guard encloses the work and cutter during the shaving operation.

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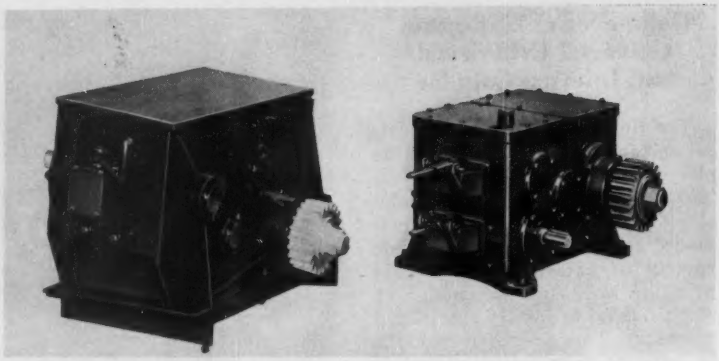

(Left) Heavy-duty, two-speed transmission before redesigning, and (right) after redesigning to use Foote "Duti-Rated" gearing.

Ex-Cell-O Tool-Grinding Machines

Two new tool-grinders are being introduced by the Ex-Cell-O Corporation, Detroit, Mich. Both machines are double-end models with reversible motors, suitable for sharpening high-speed steels, cast alloys, and carbides of all types. They have large, easily adjusted tool-rest tables.

The Style 46-D machine, Fig. 1, is a general-purpose tool-grinder using 6-inch plate type wheels for face-grinding. It has a new built-in motor spindle that is permanently lubricated. Coolant flows by gravity from a reservoir above the spindle. The tool-rest table and the spindle are at a height convenient to the operator.

The Style 49-A machine, shown in Fig. 2, is a heavy-duty model using 14-inch wheels for fast sharpening of large tools and for rough-grinding of smaller sizes. It is supplied with a pressure coolant system having individual control valves at both sides of each wheel. This model has a coolant settling tank which is easy to clean.

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Foote "Duti-Rated" Gearing

The Foote Bros. Gear & Machine Corporation, Chicago, Ill., is manufacturing a line of "Duti-Rated Lifetime Gearing" designed to reduce size, weight, and cost of equipment, yet maintain or increase the capacity. The "before" and "after" views in the illustration, of a heavy-duty, two-speed transmission give some idea of the reduction in size made possible by using these gear units.

In the original design, shown at left, the transmission weighed over 1000 pounds and occupied a space of 14,432 cubic inches. The new model, at the right, weighs several hundred pounds less, has been reduced 46 per cent in volume, and yet has the same capacity.

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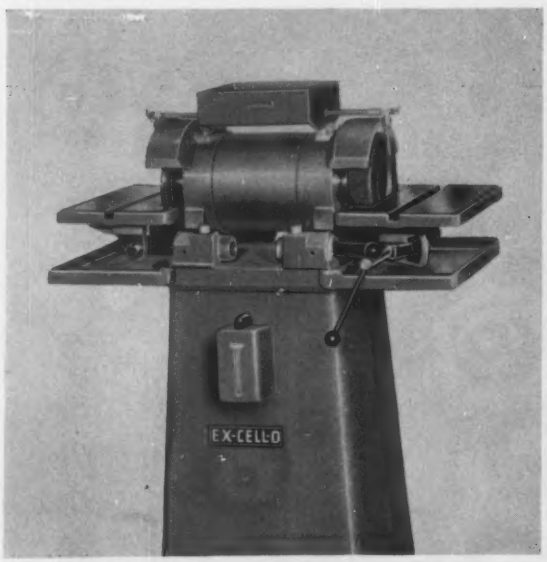


Fig. 1. Ex-Cell-O general-purpose tool-grinder

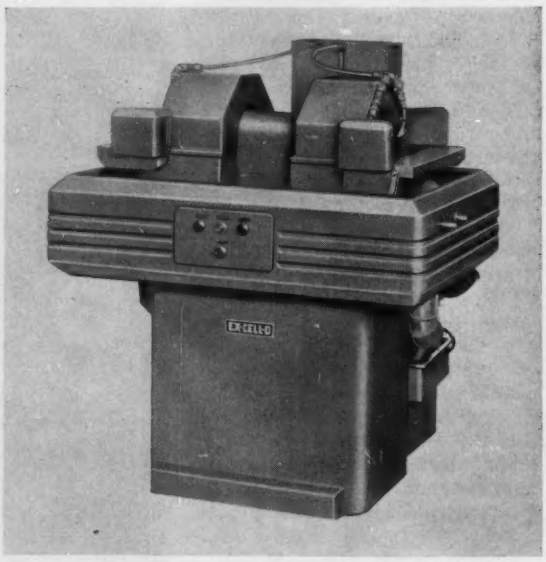


Fig. 2. Ex-Cell-O heavy-duty tool grinding machine

General Electric Fractional Horsepower Motors

A new totally-enclosed, split-phase fractional horsepower motor, Fig. 1, that is smaller and a third lighter than previous designs, has been announced by the General-Purpose Component Motor Department of the General Electric Co., Schenectady, N. Y. This fan-cooled motor is designed especially for driving light machine tools and materials-handling systems and providing dependable continuous service under severe conditions of dust and dirt. It has large-size ball bearings developed to absorb heavy thrust loads, and requires no lubrication for ten years' normal service. Easily accessible base slots simplify installation. The motor is made in NEMA 48- and 56-frames, and is available in ratings of 1/6 H.P., 1140 R.P.M. up to 1/3 H.P., 3450 R.P.M., 60- and 50-cycle models.

An end-mounted type, fractional horsepower motor, Fig. 2, provided with a special new grease for increased bearing life, has also been announced. The grease gives long-time lubrication with little maintenance and helps the ball bearings to absorb heavy end-thrust loads. Stator windings are highly resistant to heat, aging, moisture, and electrical stresses. Ventilation by means of a large, cast-aluminum fan supplies an effective cooling system. This motor is available in open and totally-enclosed fan-cooled models.

Open models are especially designed for continuous or intermittent operation of close-coupled centrifugal pumps mounted either vertically or horizontally. Both models are available in ratings from 1/4 H.P., 1725 R.P.M. up to 1 H.P., 3450 R.P.M.

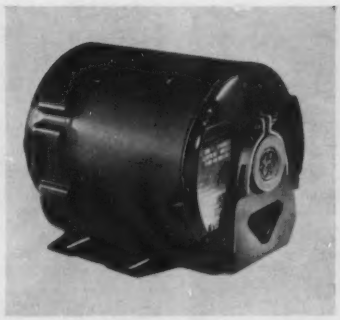


Fig. 1. General Electric totally-enclosed type split-phase fractional horsepower motor

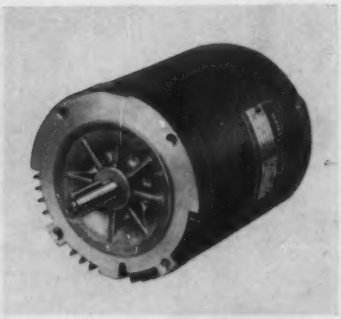


Fig. 2. G-E end-mounted fractional horsepower motor made in open and enclosed fan-cooled models

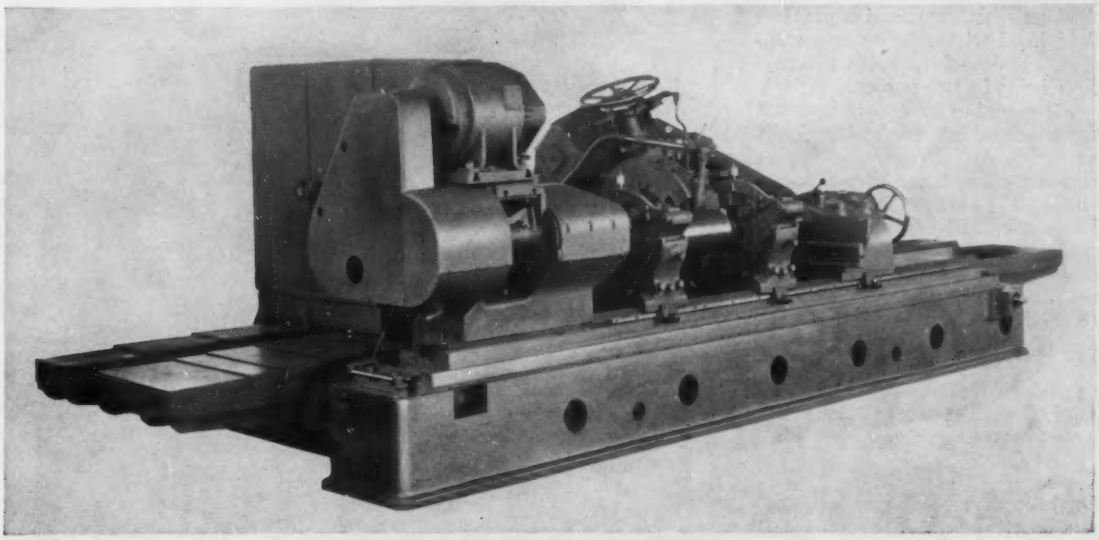
Circle Item 112 on postcard, page 255

Landis Roll Grinding Machine

A new roll grinding machine, built to handle rolls up to 25,000 pounds in weight and up to 36 inches in diameter, has been built by the Landis Tool Co., Waynesboro, Pa. The grinding wheel of this machine is traversed across the face of the roll, crowning and concaving it to precision limits. A swivel table is provided under the work-head and footstock to permit grinding tapers. Work length capacities between centers are 120, 144, 168, 192, 216, and 240 inches.

The grinding wheel is 36 inches in diameter and is driven by a 40-H.P. motor. Traversing of the wheel-head is variable from 2 to 100 inches per minute. All controls for wheel feed and traverse, as well as the rheostats and electrical push-buttons, are grouped at a central station within easy reach from the operator's seat at the side of the grinding wheel.

The pressure-lubricated Microsphere wheel-spindle bearings in the massive wheel-head are submerged in filtered oil pumped from a separate reservoir. Failure of the oil pressure system causes the wheel-drive motor to stop. Settings for crowning and concaving are easily made at the rear of the machine to produce mathematically accurate curves on repeat settings.



Roll grinding machine brought out by the Landis Tool Co.

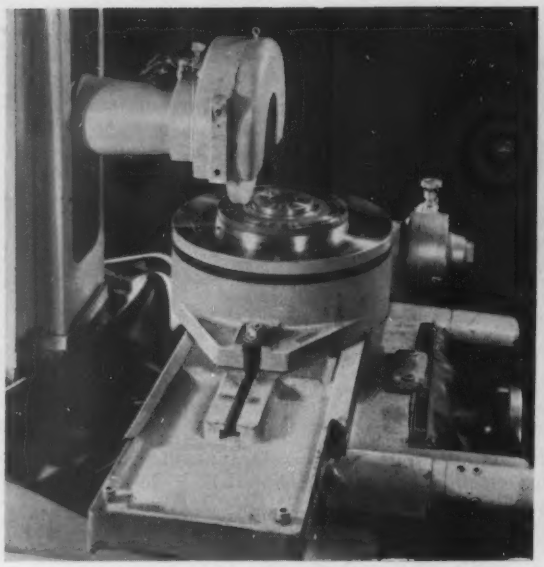


Fig. 1. Vulcan rotary table for surface grinders

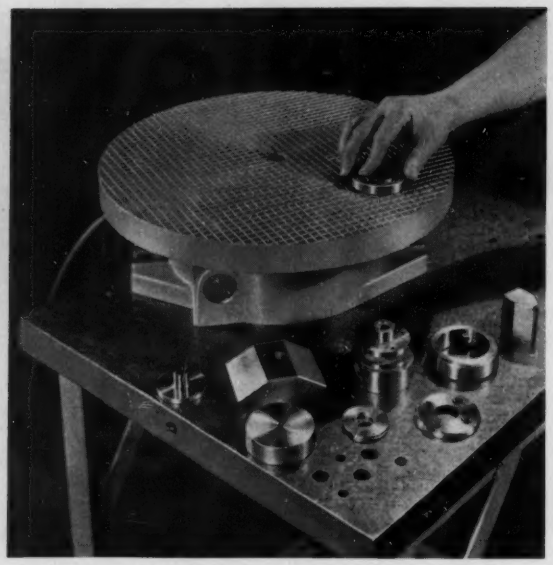


Fig. 2. Lapping plates made by the Vulcan Tool Co.

The V-belt drive to the headstock provides a variable work speed of from 12 to 100 R.P.M. Either a 7 1/2- or 10-H.P. motor is used for this drive, depending on the diameter of the roll neck.

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Zagar Special Multiple-Spindle Drilling Machine

Thirty-seven holes, each 0.128 inch in diameter and spaced only 0.3125 inch between centers, are drilled in a gas burner on a special machine recently built by Zagar Tool, Inc., Cleveland, Ohio. The machine includes a hydraulic feed unit, fixtures, and a gearless drill head with thirty-seven spindles. This machine drills seventy-four holes in two passes.

All machine movements, except fixture clamping, are hydraulically actuated. An air-operated fixture securely clamps the burner in position. The Zagar feed unit delivers the drill head to the work, feeds the drills to depth in the casting, and returns the head to the starting position. The various components of the drilling unit are mounted on a single base, 16 inches wide by 40 inches long. This equipment drills 5180 holes per hour. It is built to J.I.C. standards.

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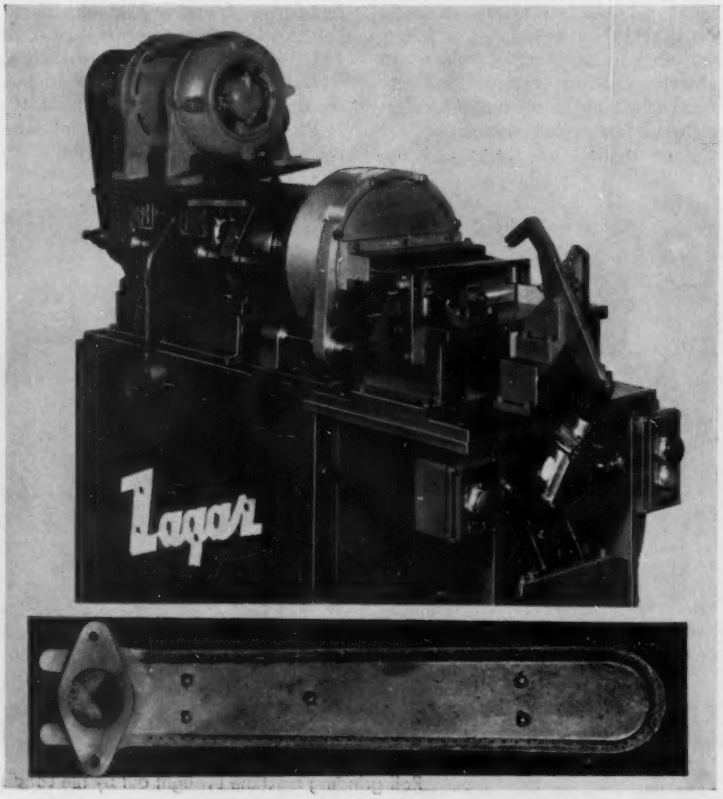

(Top) Zagar multiple-spindle drilling machine. (Bottom) Gas burner in which thirty-seven closely spaced holes are drilled by machine illustrated

Vulcan Rotary Table and Lapping Plates

The Vulcan Tool Co., Dayton, Ohio, is now manufacturing an air-operated rotary table for surface grinding machines. This rotary table, seen in Fig. 1, uses regular air-line sources for power and attains variable speeds of 40 to 100 R.P.M. It serves as an economical portable attachment for the surface grinding of flanged studs or bushings, bearing spacers, forming rolls, convex or con-

cave surfaces, flush-pin gages, punches, or dies.

Tables 6 and 10 inches in diameter are available. Since only the machine cross-feed is used, this is said to reduce machine errors and save time. The table can be used on a sine plate or angle fixture, mounted on a standard surface grinder. The table can also be used with standard permanent magnetic chucks or simple fixtures made to suit the part.

Lapping plates, such as shown in Fig. 2, are also being made by the manufacturer for converting the rotary table into a portable or bench type lapping machine. By mounting the lapping plate on top of the rotary table, an inexpensive lapping machine is made available for use in the tool-room.

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Hardinge Second-Operation Machine with Push-Button Controlled Speeds

Any spindle speed within the range of 230 to 3500 R.P.M. can be obtained instantly by simply touching a button on the control box of the Model DSM59 second-operation machine now being manufactured by Hardinge Brothers, Inc., Elmira, N. Y. The control box, located conveniently over the headstock, allows the operator to increase or decrease the speed of the spindle to suit the work. With this control, speeds are changed without stopping the spindle.

This machine is designed to reduce tooling, maintenance, and "down" time costs by enabling partially finished parts to be finished to close tolerances by rapid second-operation turning, forming, boring, drilling, threading, and facing with low-cost tooling.

A lever-operated ball-bearing collet closer permits opening or closing a collet or step chuck while the machine is in operation, and provides a means of applying collet tension from light to heavy for varying the holding power. The new 5C round Hardinge collet has a capacity of 1 1/16 inches. The pre-loaded ball-bearing turret-head mounting eliminates all play between the turret-head and turret-slide. When less than six operations are performed, savings in time can be made with the adjustable operating lever which permits rapid swiveling past the turret stations that do not have tools.

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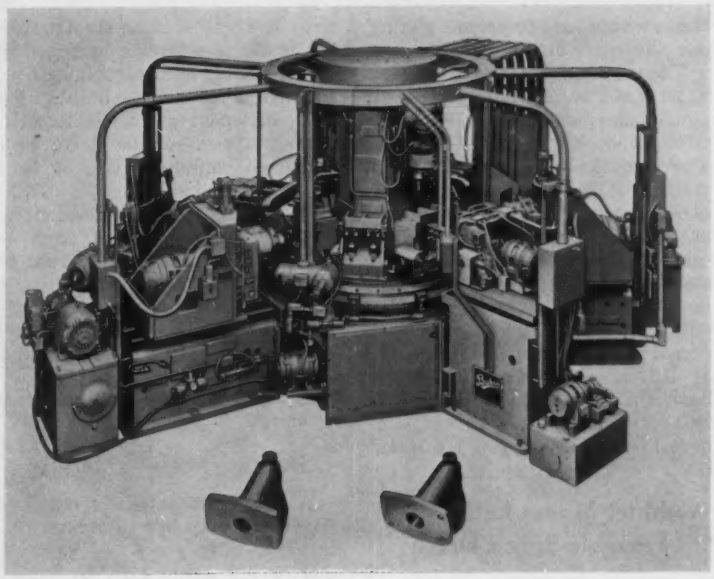
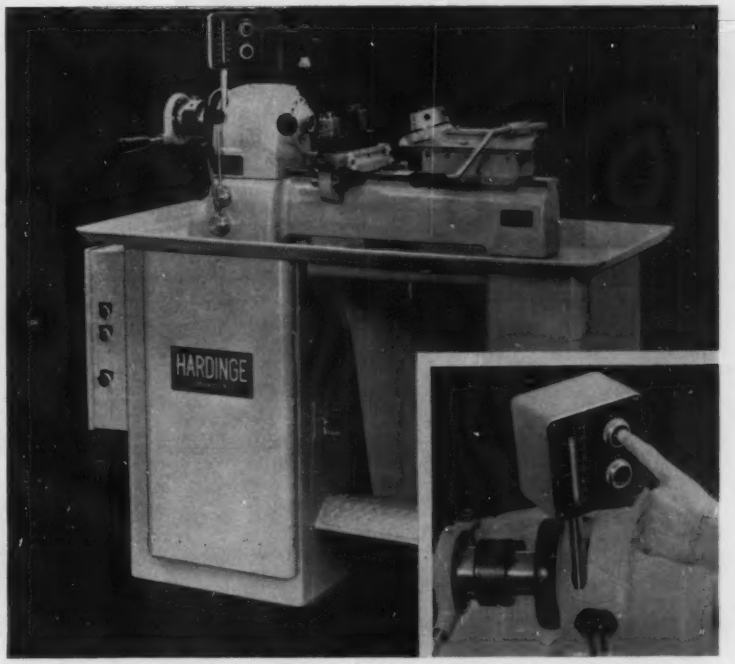


Special machine for processing master brake cylinders developed by the Buhr Machine Tool Co.

Special Machine for Processing Master Brake Cylinders

A seven-station machine that mills, core-drills, drills, reams, chamfers, and taps 288 master-brake cylinders per hour is a recent development of the Buhr Machine Tool Co., Ann Arbor, Mich. The machine is equipped with a 72-inch, power-driven indexing table complete with indexing bolt and table hold-down clamps at rough- and finish-milling stations. The indexing table has chip paddles for automatic disposal of chips and an indexing mechanism which may be easily serviced by taking off a cover at the front of



Second-operation machine manufactured by Hardinge Brothers, Inc.

the machine base to permit sliding out the entire unit.

The parts are loaded two to each fixture and automatically clamped and unclamped by means of a power wrench with torque control. The electrically controlled automatic indexing unit is of the cam-and-roller type designed to guarantee uniform acceleration and deceleration of the indexing movement. Tapping spindles are of the individual lead-screw type with precision-ground and chromium-plated threads. Multiple heads are of ball-bearing construction and have shaved gears and broached-and-splined drives.

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Cabinet Model Lathe with Variable-Speed Drive

The Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa., is entering the metal-working lathe field with the introduction of a cabinet model 11-inch variable-speed drive lathe having a center-to-center distance of 24 inches and a 1-inch collet capacity. The hole through the spindle is 1 3/8 inches in diameter. This lathe has been designed to meet the needs of tool and die shops and industrial metal fabricating shops. A back-gear shift lever, located on the front of the machine within easy reach of the operator, eliminates any need for using wrenches, pulling out pins, or opening guards to shift from a direct-spindle drive to a back-gear spindle drive, or to a loose or locked spindle.

A stepless variable-speed drive offers a speed range of from 44 to 1550 R.P.M. Speeds can be changed without stopping the machine. Accessories include taper-turning attachment, micrometer stops, milling attachments, and a standard type of collet chuck.

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Baker Special Machine

A special machine designed to perform thirty operations on differential ring gears for an automobile has been built by Baker Brothers, Inc., Toledo, Ohio. This machine spot-drills, chamfers, drills, and taps eight blind holes in steel. Features of the new machine include an individual lead-screw tapper with magnetic clutch control. Drilling operations are performed by a Baker Model 26 HO unit of twin pull cylinder construction. Estimated production on this Baker machine is 144 parts per hour.

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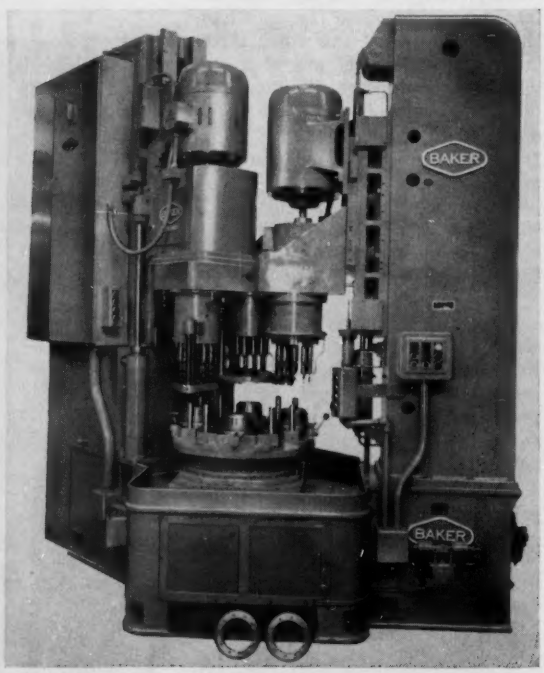
Snyder Special Automatic Four-Way Drilling Machine

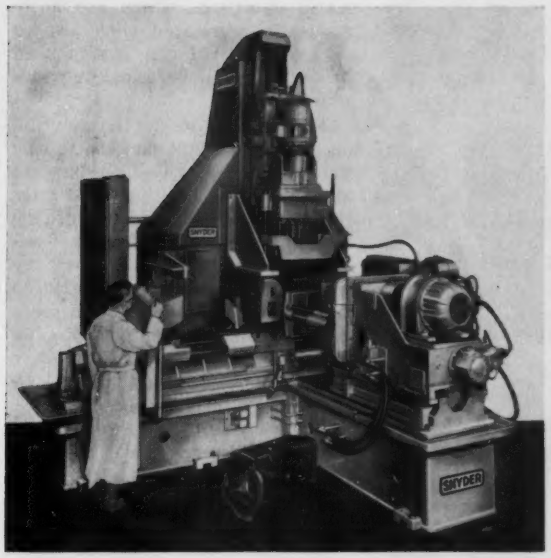
A special automatic, four-way drilling machine for cast-iron tractor transmission cases has been developed by the Snyder Tool & Engineering Co., Detroit, Mich. The procedure consists of drilling holes in the left- and right-hand sides and in the bottom and rear of the transmission case, which is a rectangular casting about 30 inches long. The machine has four self-contained hydraulic feed drill units arranged around the work-holding fixture. One unit is mounted vertically and three units are positioned horizontally, and all carry multiple-spindle heads. A hydraulically operated slide moves the fixture out for loading.

Guide fingers and approximate locators assist the operator in guiding the part down into an approximate clamping position. Final location is accomplished by pilots which enter the main and camshaft bores in the rear end and center web of the part. When located, the part is hydraulically clamped between two jaws which engage the rear face and center web. The stroke necessary to clear the jaw for loading is accomplished by means of a direct-coupled hydraulic cylinder.

Cabinet model lathe introduced by the Delta Power Tool Division of Rockwell Mfg. Co.



Baker machine for performing thirty operations on differential ring gears



Automatic machine for drilling tractor transmission cases built by Snyder Tool & Engineering Co.

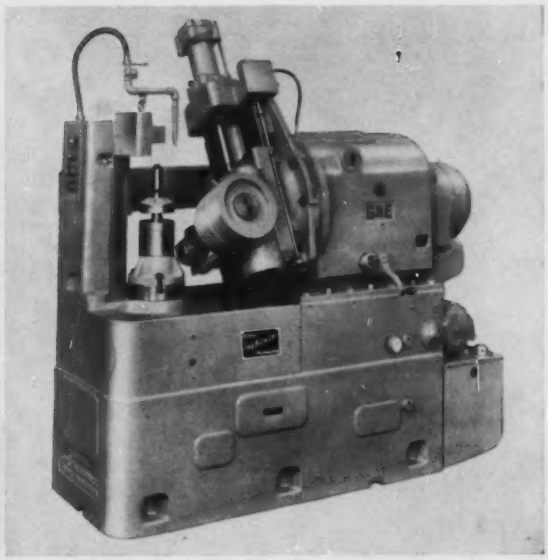


Fig. 1. "HoBlique" helical gear-hobbing machine brought out by Gould & Eberhardt, Inc.

The work cycle is automatic after loading and starting the machine, which is electrically interlocked to protect both operator and equipment. High-speed steel tools are used at a speed of 80 surface feet per minute. Production is at the rate of thirty parts an hour at 80 per cent efficiency.

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Gould & Eberhardt "HoBlique" High-Speed Gear-Hobber

A compact, helical gear-hobbing machine, designed for the high-speed mass production of helical gears, has been built by Gould & Eberhardt, Inc., Irvington, N. J. The outstanding feature of this "HoBlique" machine, as it is called, is the feeding cycle. This consists of feeding the hob tangent to the helix of the gear being cut, employing the automatic "TriLineal" feeding cycle which provides three feed rates in series—two successive fast enter feeds operating at different rates, followed by the normal hobbing feed.

The machine embodies a fully automatic cycle actuated by a single push-button. The operator loads the work and presses the start button. The work-support arm is then quickly lowered and locked, at the same time the work is clamped. The hob rotates and climb-feeds at two successive fast-traverse rates, followed by normal feed. Then the hob stops and returns rapidly through the cut, after which the support arm is quickly elevated and the work clamps released, permitting the operator to unload the work.

Since the machine is intended primarily for cutting helical gears preparatory to shaving, full advantage can be taken of multiple-thread hobs. For some applications, accuracy obtained with single-thread hobs is suitable for finish-hobbing gears in one cut.

The machine is adaptable for a wide range of right- and left-hand helical gears up to a 45-degree helix angle. Hob speeds up to 550 R.P.M. are available. The machine will handle gears from 2 3/4 to 10 inches in diameter, 8 to 14 normal diametral pitch, and a maximum face width of 6 inches. The two truck transmission gears seen in Fig. 2 are cut in one setting with the double-thread hob set-up shown in Fig. 1, at the rate of 1.2 minutes per gear.

Circle Item 121 on postcard, page 255

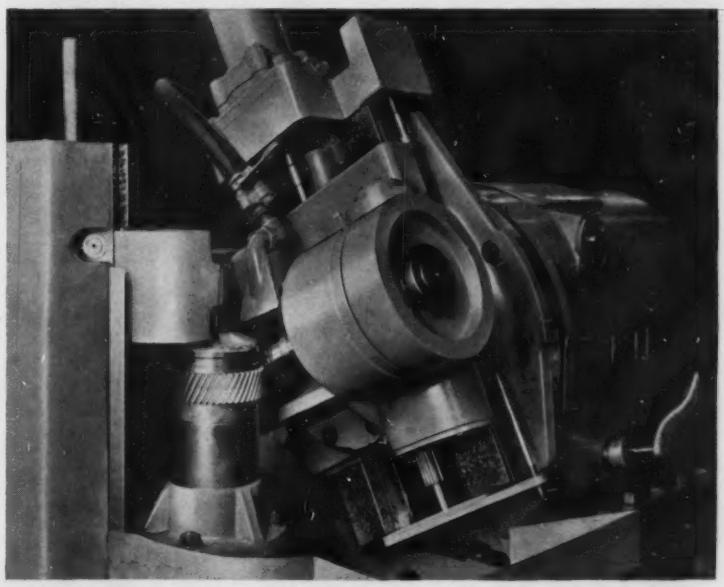


Fig. 2. Cutting two helical gears per setting on gear-hobbing machine

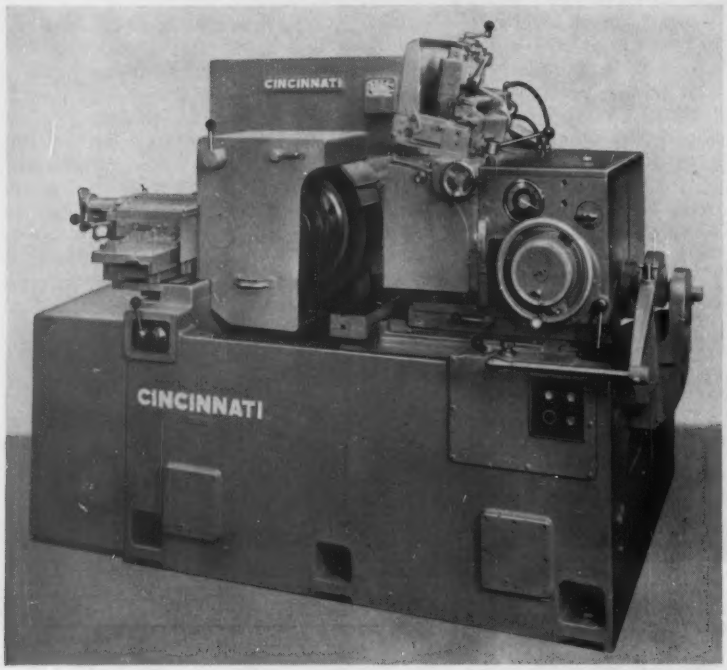


Fig. 1. Centerless grinding machine built by Cincinnati Grinders Incorporated.

Cincinnati "Filmatic" Centerless Grinding Machine

The new No. 2 centerless grinding machine recently announced by Cincinnati Grinders Incorporated, Cincinnati, Ohio — 1000 pounds heavier than its predecessor—has many new features developed to facilitate the handling of a wide range of precision grinding work. The grinding wheel spindle has self-adjusting "Filmatic" bearings which are automatically lubricated with filtered oil from a circulating system, and protected by an electrical pressure switch.

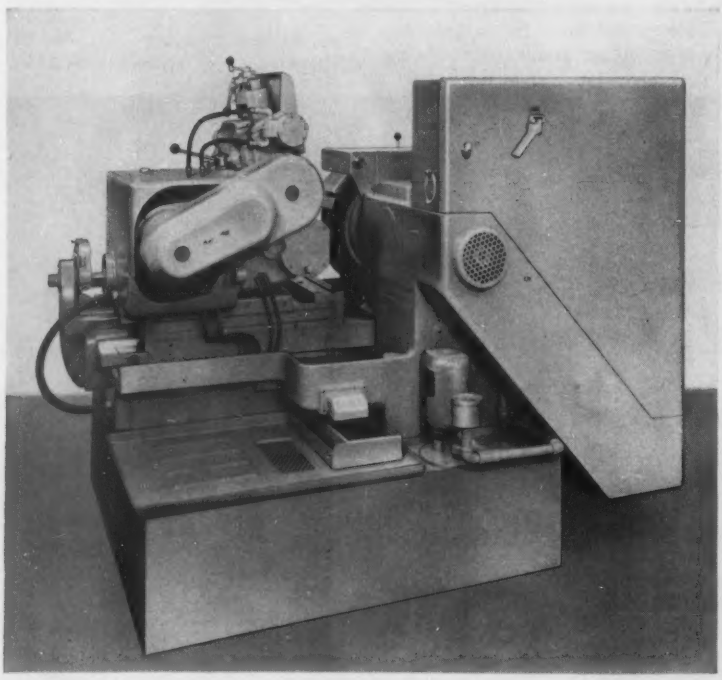


Fig. 2. Rear view of the Cincinnati machine shown in Fig. 1

The lower slide unit, mounted on ways at right angles to the grinding wheel spindle, supports an upper slide unit which carries the regulating, or feed, wheel. This type of construction simplifies setups and sizing adjustments because the work-rest is mounted on the lower slide, where it can readily be positioned in proper relation to the two wheels. The entire regulating wheel unit may be swiveled slightly on the bed.

In operation, the upper and lower slides are locked together and glide as a unit over the anti-friction bed ways. The regulating wheel is driven by a built-in 1 1/2-H.P. motor, through backgears and a wide V-belt. Regulating wheel speeds are infinitely variable, within two ranges, from 11 to 320 R.P.M. Speed changes are accomplished with variable-pitch sheaves, handwheel selected and indicated on a tachometer.

Both grinding and regulating wheel spindle bearings are automatically lubricated with circulating filtered oil from the central hydraulic system. Other bearings within the slide units are lubricated from an oil-shot system. A power-operated profile-truing attachment is standard equipment for the grinding wheel. Two external controls are located on the operating side of the bed, one to engage rapid and truing rates and change the direction of traverse; and the other, to change the rate of traverse. Regulating wheel truing is accomplished through a straight hand-screw type unit. However, power-operated truing is available.

The in-feed handwheel is now located on the upper slide, at the operator's working position. It has 0.0001-inch and 0.001-inch graduated dials. For in-feed grinding, the operator uses the lever connected directly to the in-feed screw. A 90-degree downward and return movement of this lever completes a cycle.

The motor and electrical controls are enclosed and the machine is wired to comply with J.I.C. standards. Electrical controls are contained in a sheet-metal unit at the rear of the machine which is equipped with a safety interlock switch and a "loadmeter" to show the horsepower being used.

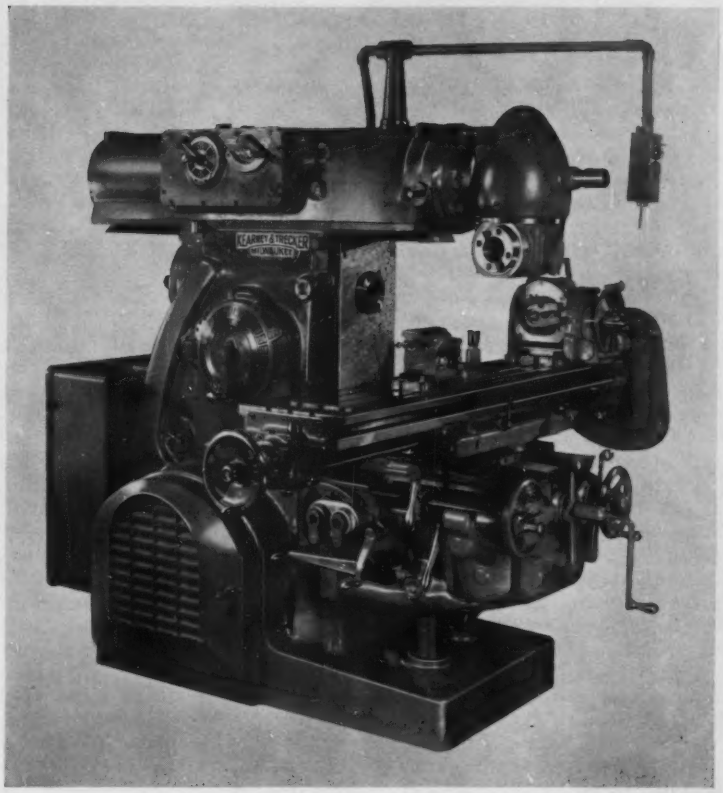
Circle Item 122 on postcard, page 255

Kearney & Trecker Ram Head Milling Machine

A line of dual-purpose knee type ram head milling machines has been introduced by Kearney & Trecker Corporation, of Milwaukee, Wis. The machines combine a conventional horizontal spindle and a self-contained motorized sliding ram for adjustable cutting heads. With this arrangement, horizontal and vertical spindles can be run separately or simultaneously.

The ram head machines are available with a choice of three cutting heads—universal, vertical, and quill types which can be rotated through 360 degrees. This permits the user to perform vertical, horizontal, and angular milling operations on one machine in a single set-up. The ram head type machines are said to be highly versatile and exceptionally economical for general-purpose production milling. The machines are built in sixty-nine different working range combinations, and in sizes from Nos. 2 to 4, both plain and universal. Either a standard directional table control, or an automatic-cycle table control, can be provided. The ram head is individually motor-driven and has its own lubrication system and speed-change mechanism. When used as a standard horizontal machine, the ram acts as a heavy-duty arbor support.

Circle Item 123 on postcard, page 255



Knee type ram head universal style milling machine recently introduced by the Kearney & Trecker Corporation

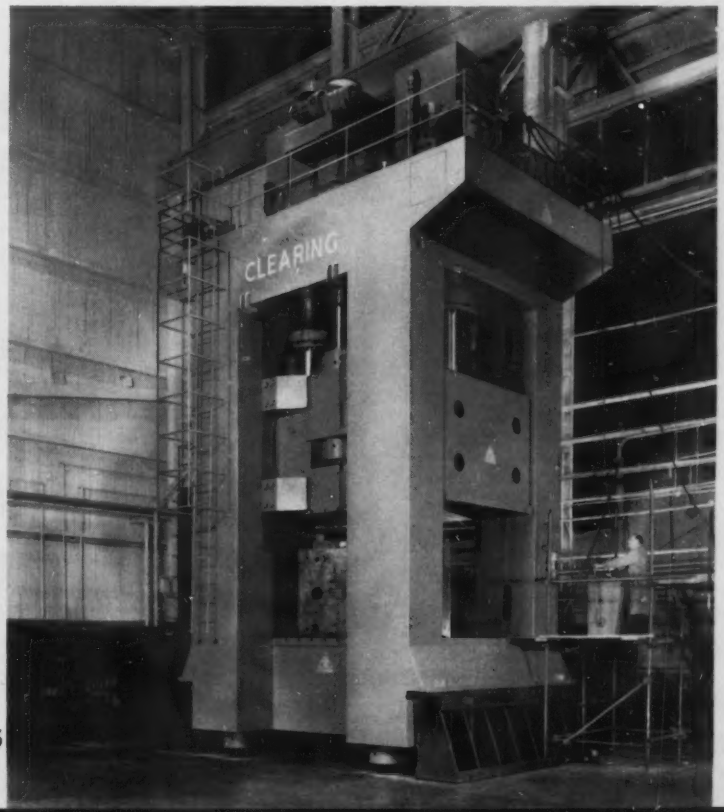
Clearing Press Built to Trim Large Aluminum Forgings

A huge 2000-ton hydraulic press designed to trim massive aluminum forgings has been built by the Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill. This machine exerts a continuous pressure over an unusually long stroke. Since the forgings handled by the press vary greatly in size, provision is made for quick and easy adjustment of the stroke length.

The machine is of the housing type with pre-loaded tie-rod frame construction which resists the effects of off-center loading. A unique system for taking care of "break-through" shock is built into the press by which movement of the slide is restrained as it attempts to accelerate and continue its stroke.

Circle Item 124 on postcard, page 255

Clearing press designed to trim large aluminum forgings



Elmes Double-Action Drawing and Forming Press

A housing type, self-contained double-action drawing and forming press, said to incorporate many advanced construction and operating features, has been brought out by the Elmes Engineering Division, American Steel Foundries, Cincinnati, Ohio. This multiple-ram press is equipped with a die cushion and has pre-shrunk tie-rods for maximum rigidity and accurate alignment. The guideways for slides are of hardened steel. Hand-scraped gibs make possible close-tolerance gib adjustments.

An important construction feature is the use of eight ring-type keys to insure "all directional" alignment of press crown, bed, and housings. The multiple-ram arrangement provides maximum flexibility of operation and greater pressing speeds for work requiring less than maximum press tonnage. For single-action operations of the blank-holder and main platen, the respective capacities (blank-holder 100 tons, main platen 300 tons) are combined to obtain a total operating capacity of 400 tons.

Stroke and speed change adjustments are controlled from the front of the press, at floor level. This arrangement permits the operator to make adjustments while the press is in action and to observe the position of the ram at the same time. Manual, hydraulic bleed-off type inching control is provided for die-setting, making possible control of slide movement to within a few thousandths of an inch. A separate panel is furnished equipped with controls for individual corner pressure adjustment of the blank-holder slide.

Circle Item 125 on postcard, page 255

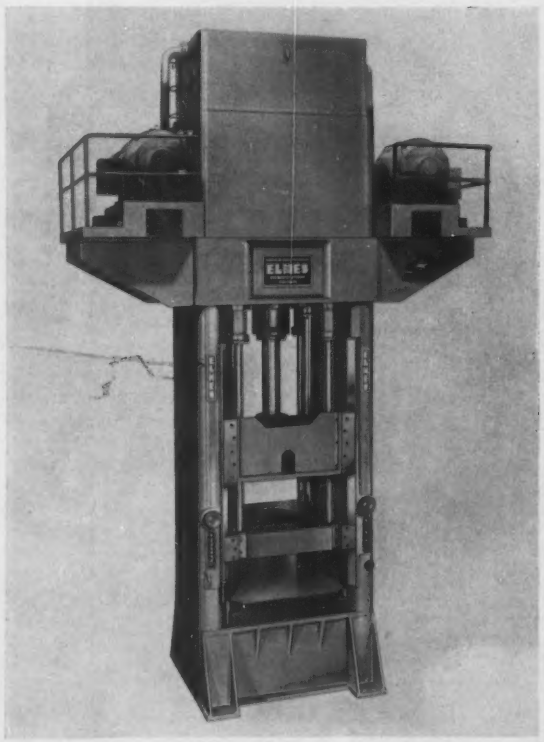
Deckel Universal Milling Machine

A Model FP2 Deckel universal milling and boring machine of improved design is being introduced in this country by the Cosa Corporation, New York City. This machine is designed to perform accurate drilling, boring, slotting, and milling operations (vertical, horizontal, angular, or spiral). Improvements over an earlier model include increased size of workpiece capacity and an increase in the number of speeds and feeds that are available.

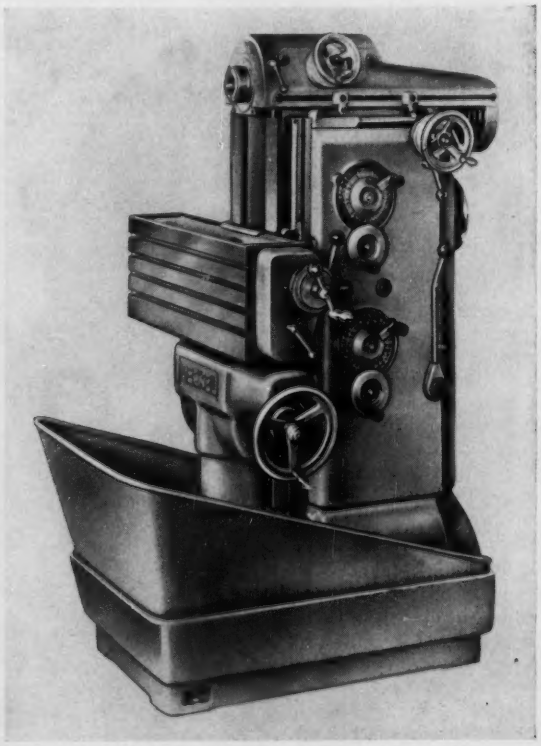
The machine has a built-in motor, two-directional power feed to the spindle head, and axial adjustment of the spindle in the head. The eighteen spindle speeds range from 40 to 2000 R.P.M., and the eighteen feed rates from 0.315 inch to 15.8 inches per minute. Directional single-lever control is provided for the table feed. Rapid power traverse is available in all directions. The swivel type vertical boring and milling head has three feed rates.

The machine is equipped with a 3-H.P. motor and an over-arm for extending the horizontal spindle. Special attachments include a vertical spindle head, a high-speed vertical spindle head, a milling and boring head, a slotting attachment, fixed and swiveling angular tables, a circular table, a jig boring table, an index-head, and a spiral milling attachment.

Circle Item 126 on postcard, page 255



Double-action drawing and forming press built by Elmes Engineering Division, American Steel Foundries



Improved Deckel universal milling machine which has been introduced by the Cosa Corporation

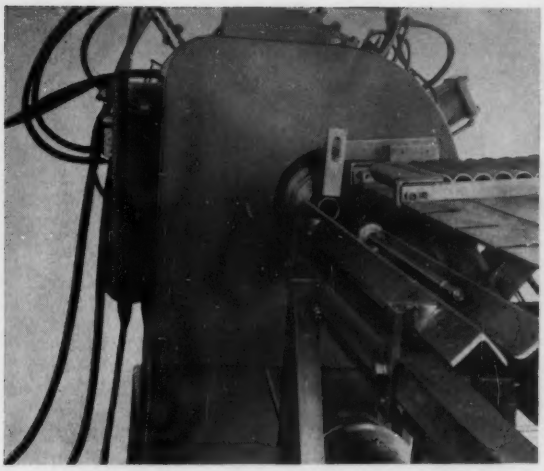


Fig. 1. Inclined rack-feed end of hot-spinning machine built by Modern Machine Tool Co.

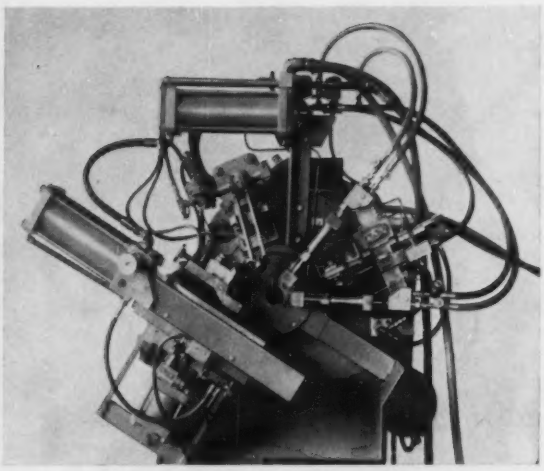


Fig. 2. Spinning and welding end of machine shown in Fig. 1 which closes and welds tube ends

Hot-Spinning Machine Designed to Weld and Close End of Tubing

The Modern Machine Tool Co., Jackson, Mich., has brought out a hot-spinning machine designed to close one end of a piece of tubing. This machine automatically feeds the tube, heats it to the proper temperature, seals the end by spinning and welding, and ejects the piece, all in a matter of seconds. All the operator has to do is stack the pieces of tubing in the inclined rack, seen in Fig. 1, and take them away when the operation is finished.

The machine handles tubing up to an outside diameter of 3 inches, and is designed to use either oxy-acetylene or induction heating. It is furnished with motors, starting equipment, collet, bushing, valves, and cylinders, as well as electrical equipment, including a transformer.

Circle Item 127 on postcard, page 255

"Unitool" Method for Producing Gears with Single Cutter

A "Unitool" method, for cutting a wide variety of spiral bevel, Zerol bevel, and hypoid gears with a single cutter, has been applied by the Gleason Works, Rochester, N. Y., to Nos. 106 and 116 hypoid generators. The method adapts the machines to cutting gears in small-lot quantities, as in the case of experimental gears without requiring trained personnel.

By the "Unitool" method, spiral bevel and Zerol bevel gears of any ratio can be cut, and hypoid gears of 3 to 1 ratio and higher. The same cutter is used for both the driving and driven gears of a pair, and each gear is completed before removing it from the machine.

The cutters are of the segmental type, and require no shimming or adjusting. Each cutter covers a wide range of work sizes, and the combined range of the two machines mentioned is covered by only six cutters. Calculations for the machine are relatively simple.

Zerol bevel gears can be cut from blanks designed for straight bevel gears. Thus it is possible to obtain the effect of bevel gears without the necessity of having a separate bevel gear generating machine.

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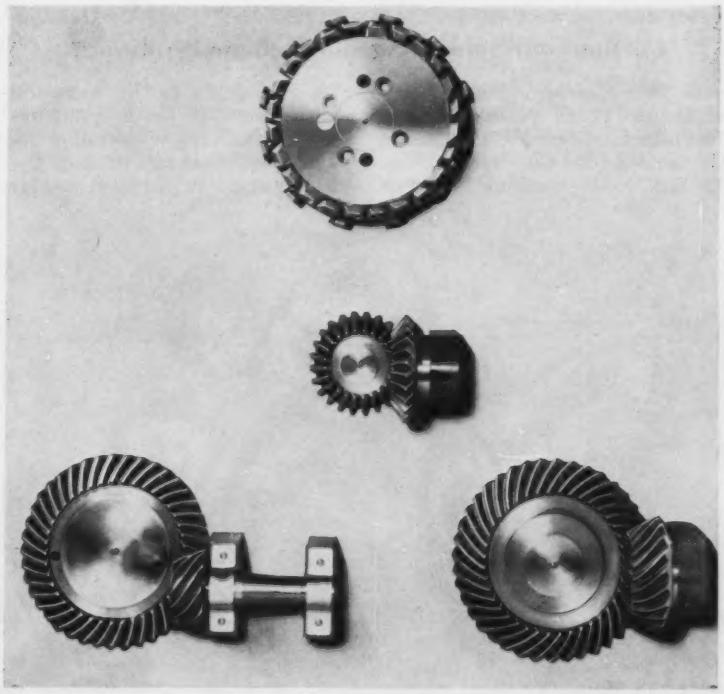

Typical gears cut with a single cutter by the new Gleason "Unitool" method. A pair of Zerol gears is shown in the center, and a pair of hypoid gears at the lower left. At the lower right is a pair of large spiral gears.

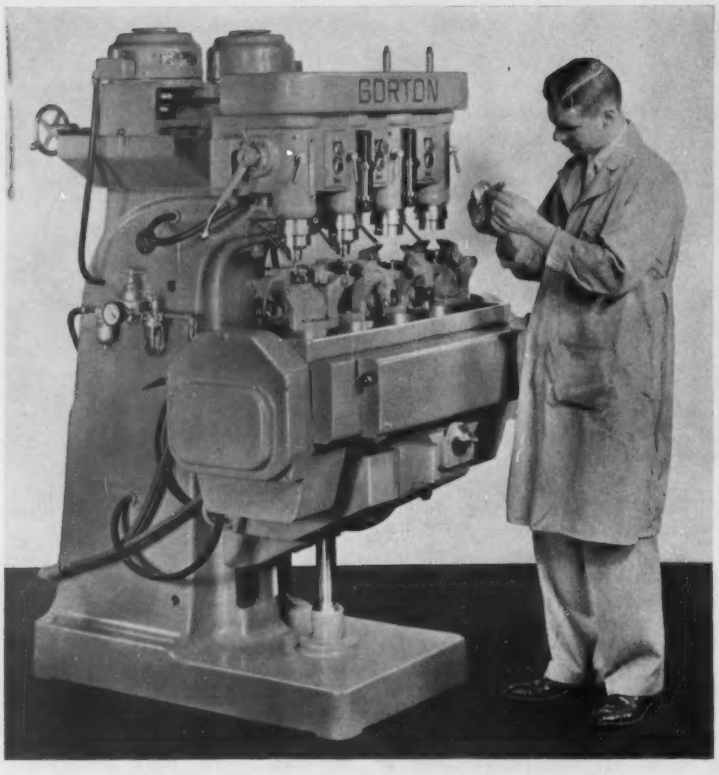

Fig. 1. Gorton four-spindle rotary duplicator that performs profiling operations on two gear blanks simultaneously with two spindles while fixtures under the other two spindles are being reloaded for same operations

Gorton Four-Spindle Semi-Automatic Duplicator

A four-spindle duplicator designed for high production has just been introduced by the George Gorton Machine Co., Racine, Wis. In Fig. 1, the machine is shown with two heads in the operating position and two heads in the unloading, gaging, and reloading position. The heads and rotating fixtures operate in pairs, each pair of fixtures being governed by a separate master. Two masters, one for each pair of fixtures, are located within the table assembly of the machine.

Two different pairs of parts can be produced simultaneously. In the application illustrated, all pieces are identical. The operation consists of milling two locking lug recesses in bevel gear blanks, such as shown in Fig. 2, at a rate of 100,000 pieces per month. The recesses are 5/32 inch deep and 13/64 inch wide. The parts are made of S A E 4615 cold-drawn steel having a Brinell hardness of 180 to 210.

After the cutter-spindles have been set for the required cutting depth, fixtures holding the work by air-operated clamps rotate and move in and out from the column face, guided by the concealed masters. In this way, the two recesses are milled to exact shape and size in one pass. All movements are protected by electrical interlocks. For example, one pair of spindles and holding fixtures will not operate until the other spindles are raised above the work.

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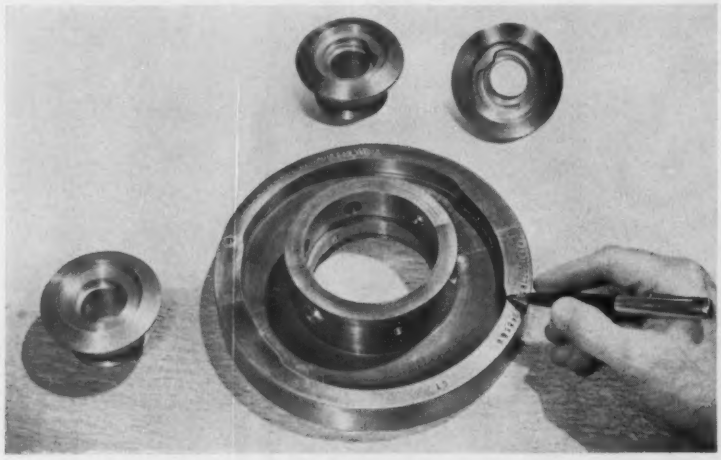
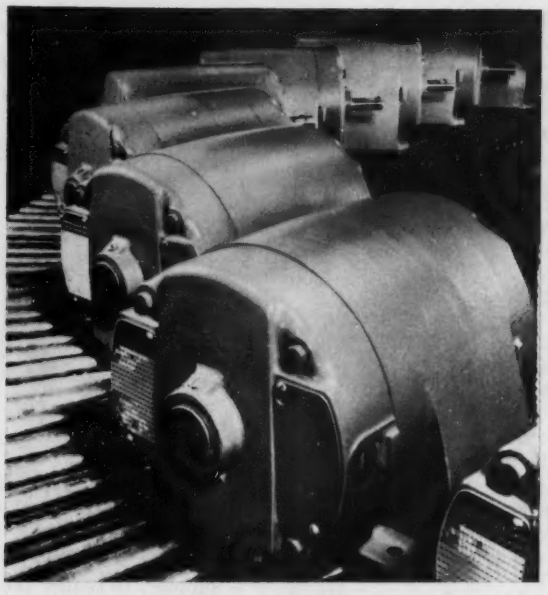


Fig. 2. Master cam which guides table movement of duplicator during profiling operations, together with two finished blanks and one blank before profiling

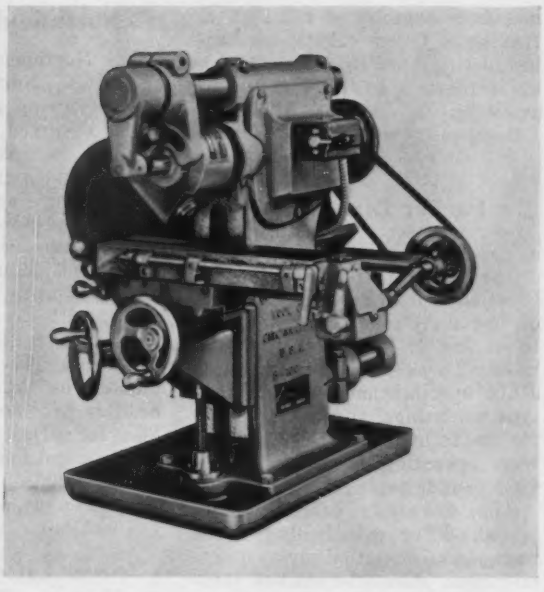
General Electric Tri-Clad Single-Phase Capacitor Motors

A line of Tri-Clad "55" single-phase capacitor motors featuring higher full-load speeds, overload capacity, and breakdown torque has been announced by the General Electric Co., Schenectady, N. Y. These motors are built to the latest re-rated NEMA standards. They feature size reduction and a rigid cast-iron construction, and incorporate a new insulation system, bearing assembly, and ventilation design.

Starting is accomplished by a simple centrifugal mechanism which throws out when the motor is up to speed, disconnecting the starting capacitors and switching the windings from starting to running condition. The single-phase motor can be changed from 115-volt 60-cycle to 230-volt 60-cycle operation by reconnecting the leads, and motor rotation can be reversed by simply interchanging two leads. The motor is available with various types of mounting, and with either the standard drip-proof enclosure or the totally enclosed, fan-cooled enclosure for applications where the motor will



Single-phase Tri-Clad "55" motors of new line announced by the General Electric Co.



Burke bench type milling machine which is equipped with vertical milling attachment

encounter severe contamination or weather conditions. This line of "Tri-Clad" motors is being built in ratings of from 1 to 5 H.P.

Circle Item 130 on postcard, page 255

Federal Dial Indicator and a Non-Magnetic Test Indicator

A long-range dial indicator that will measure 2 inches in increments of 0.001 inch, is now being produced by the Federal Products Corporation, Providence, R. I. This indicator, shown in the upper view in the illustration, is furnished in the "D" size. It has a 2-inch range and follows American Gage Design Committee specifications throughout, except for the length of the stem, the dust cap, and the rack. The indicator has two revolution counters that enable the user to keep track of the hands so that he can always tell which revolution of each hand is being read.

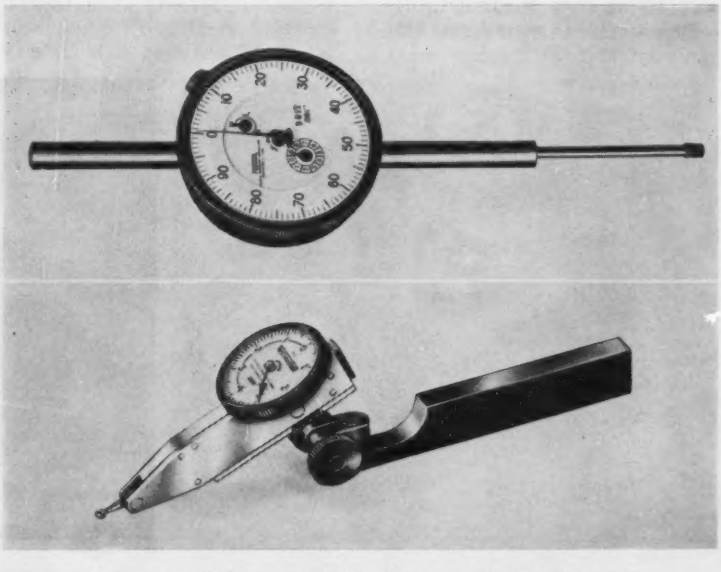
The Federal "Testmaster," shown in the lower view of the illustration, is a highly adaptable and accurate universal test indicator. It is now available in non-magnetic form. This indicator can be used with magnetic chucks, parallels, V-blocks, uprights, or wherever a magnetic field is present, with accurate readings being assured.

Circle Item 131 on postcard, page 255

Vertical Attachment for Burke Milling Machines

A vertical milling attachment designed to increase the versatility of its bench type milling machines has been announced by the U. S.-Burke Machine Tool Division, Cincinnati Ohio. This attachment is made specifically for the Burke Nos. 3 and 4 millers, but is also suitable for other small milling machines. The attachment is driven by helical gears, with both the spindle and drive arbor supported on pre-sealed precision roller bearings to permit using the most efficient spindle speeds for small end-mills.

The attachment is driven by a splined arbor, direct from the milling machine spindle. This allows the head to be moved close to or away from the spindle. In addition, the head is graduated so that it can be used for angular as well as direct vertical milling. A draw-in collet attachment, having a



(Top) Federal long-range dial indicator; and (bottom) Federal "Testmaster" non-magnetic test indicator

maximum capacity of 1/2 inch, is furnished. Other collets, increasing in size from 1/16 to 1/2 inch by increments of 1/16 inch, are available.

Circle Item 132 on postcard, page 255

Parker Directional Control Valves

The Parker Appliance Co., of Cleveland, Ohio, has added a series of five directional control valves to its line of industrial hydraulic units. These valves conform to J.I.C. specifications, have gasket type mountings, and are designed for use in hydraulic (oil) systems with operating pressures up to 2000 pounds per square inch.

The five new designs, illustrated, differ principally in the methods of actuation, being pilot-operated; solenoid-operated (single or double); and solenoid-controlled, pilot-operated (single or double solenoid). Solenoid-operated valves are rated at a recommended maximum capacity of 3 gallons per minute.

Pilot-operated valves and solenoid - controlled, pilot - operated valves are rated at a recommended maximum capacity of 22 gallons per minute. In most cases, the solenoid-controlled, pilot-operated valves are arranged for internal pilot pressure source but they can be furnished for use with an external pilot pressure source.

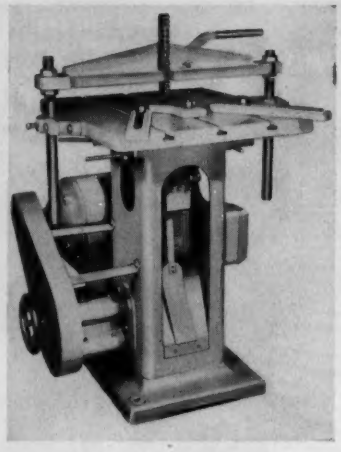
From one to six spool types are offered in each design. Solenoids are ordinarily furnished for 115-volt, 50- or 60-cycle current.

Circle Item 133 on postcard, page 255

Northfield Keyseater

The Northfield Foundry & Machine Co., Northfield, Minn., is manufacturing a Model K6 keyseater designed to cut straight or tapered internal keyways from 1/8 to 1 inch in width. Work of any diameter and shape that can be clamped to the table can be cut, grooved, or slotted. Standard equipment includes a 1-H.P. three-phase, 60-cycle, 220- or 440-volt motor with a rated speed of 900 R.P.M. A 2-H.P. motor can be furnished. The table is 25 by 29 inches. The "Alligator" type crosshead is provided with dovetailed gibs for adjustment of cutter in the base and to take up wear when necessary.

Circle Item 134 on postcard, page 255



Keyseater placed on the market by Northfield Foundry & Machine Co.

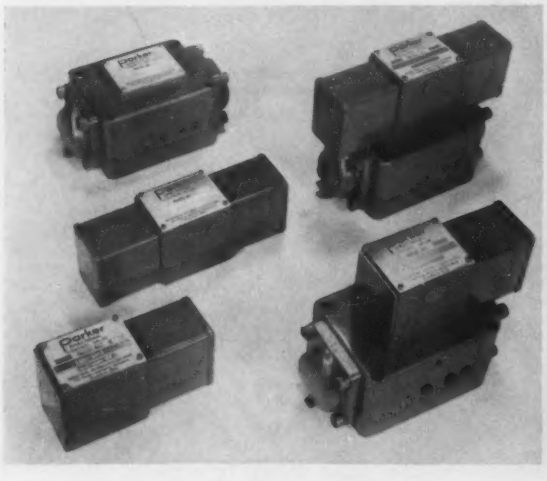
Sheet Lifter with High Vacuum Produced by Compressed Air

As long as the trigger in the pistol grip type handle of the "Pres-Vac" lifter is held down, the suction cup will pull 11 pounds per square inch. The suction is obtained by a revolutionary application of compressed air incorporated in this lifter made by the Air Division, F. J. Littell Machine Co., Chicago, Ill. The constant, positive lifting power is produced by passing compressed air through the venturi at a pressure of 45 pounds per square inch, creating a constant vacuum of 22 inches of mercury. The vacuum is conveyed to the rubber cup through passages in the lifter handle. A regulator is supplied to reduce the line pressure to the required operating pressure of 45 pounds per square inch.

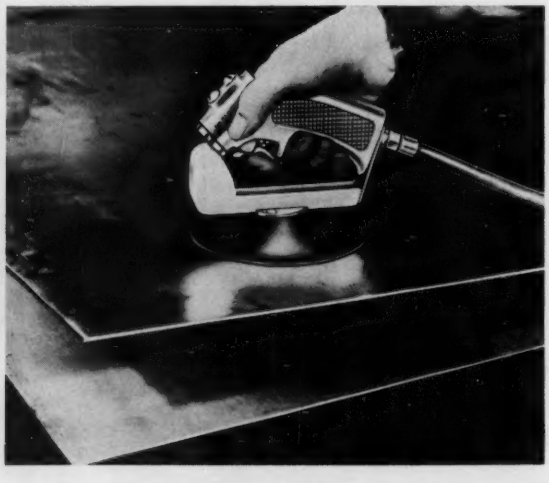
Circle Item 135 on postcard, page 255

Ross Improved Air Valves

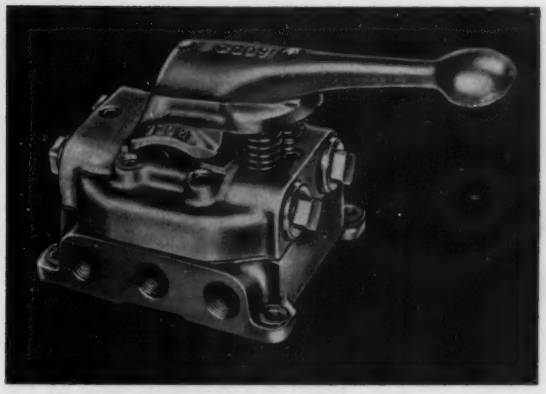
The Ross Operating Valve Co., Detroit, Mich., has incorporated important improvements in the operating mechanisms of both the three- and four-way models of its 880 Series hand- and foot-operated valves. These valves are available with single- or double-foot treadle, and vertical or horizontal hand-lever controls. They are changed from hand to foot operation by removing two screws. A separate base for bottom or side ports is



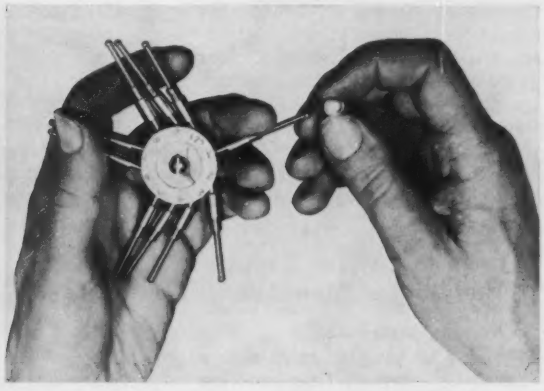
Directional control valves for hydraulic systems made by Industrial Hydraulics Division, Parker Appliance Co.



"Pres-Vac" lifter brought out by the Air Division of the F. J. Littell Machine Co. for handling sheet material



An improved model of the Ross 880 Series air valves



Merz "Microsphere" multiple precision bore gage

provided and an optional base is available to permit manifolding a series of bases to each other for simplified piping.

Both models are available in 1/4- and 3/8-inch pipe sizes. All have standard two-position locking action, but may be ordered with spring return or three-position locking action. The pressure rating is 125 pounds per square inch and the maximum recommended operating temperature is 175 degrees F., except for the foot-operated four-way model, the recommendation in this instance being 250 degrees F. All the valves may be used for higher or lower pressures and for other than air services under special conditions.

Circle Item 136 on postcard, page 255

"Omicron" Ellipsograph

An ellipsograph called the "Omicron," by means of which mathematically true ellipses can easily be drawn, is a product of the A. Partrick Co., Westwood, N. J. This instrument has a capacity for drawing ellipses having a major axis of over 12 inches, using a pencil, inking pen, or scriber needle.

Circle Item 137 on postcard, page 255

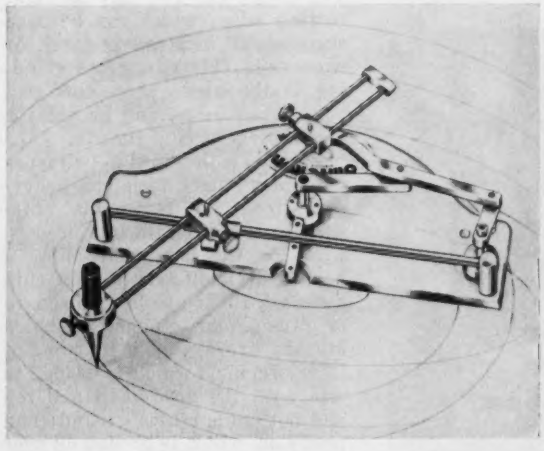
Merz Bore Gage

A "Microsphere" multiple precision gage, designed to facilitate accurate measuring of bore diameters, is being made by the Merz Co., Los Angeles, Calif. The gage consists of ten measuring spheres in any increment desired, starting at 0.0001 inch. It is used to check the size of the hole being produced during any part of the operation. These gages utilize the principle of a sphere as the measuring element. The spheres are manufactured to an accuracy of plus 0.000000 inch and minus 0.000025 inch, and can be obtained in both tool steel and hard chromium steel. They are available in standard sizes, increasing in steps of 1/64 inch, from 1/16 to 1/2 inch in diameter.

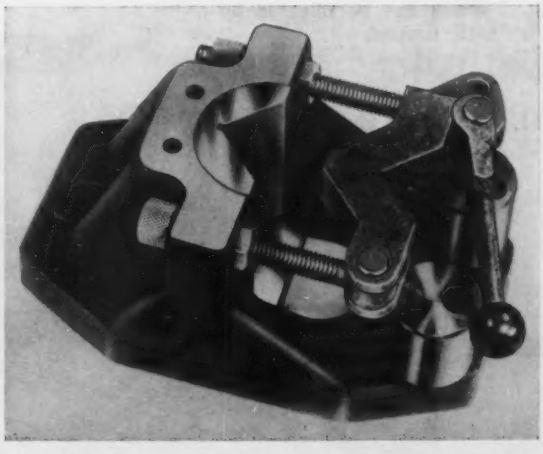
Circle Item 138 on postcard, page 255

Improved Multiple-Purpose Work-Holder

A multiple-purpose work-holder has been brought out by the Lassy Tool Co., Plainville, Conn., to provide a basic work-holding device that will eliminate the need for special fixtures. Standard interchangeable jaws and clamps are available for holding single or multiple pieces of odd as well as regular shapes. The base has a through hole to accommodate long work and is provided with a positive work-stop bar recessed into the base. Slots are provided for bolting the holder to a machine table. Accessories include counterbalance weights, a drill bushing



Ellipsograph for drawing mathematically true ellipses, introduced by the A. Partrick Co.



Multiple-purpose work-holder made by Lassy Tool Co. to eliminate need for special fixtures

plate, riser blocks, work-stops for single or multiple pieces, and extension work-stop sleeves. The quick-acting swing clamp is adjustable and assures positive clamping even when the holder is subjected to machining vibrations or fast rotation.

Circle Item 139 on postcard, page 255

Vacuum Lift for Rapid Handling of Materials

The Ingersoll-Rand Co., New York City, has brought out a "Vac-Lift" device for handling flat, non-porous materials such as television tubes, sheet metal, plate glass, refrigerator and range

Vacuum lifting device brought out by the Ingersoll-Rand Co.

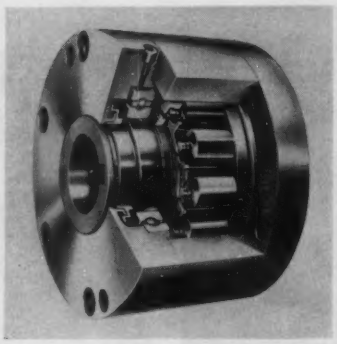
housings, stampings and castings, and boxes. This device can be used to advantage on any operation where material is moved by hand or by a sling or hook. A safety-tight seal is created by merely placing the vacuum cup on the work. Easy one-hand operation permits accurate spotting of the load which can be released by a finger-tip control.

Circle Item 140 on postcard, page 255

Heavy-Duty Cam Clutches for Indexing and General Machinery Applications

A line of heavy-duty ball bearing over-running clutches for indexing, backstop, and general machinery applications is now available from the Morse Chain Co., Detroit, Mich. These "K" series clutches embody many of the design features of the "Kelpo" over-running clutches previously made by the company.

Typical applications for clutches, which have a toothed inner race driving member that actuates



Heavy-duty cam clutch of line introduced by Morse Chain Co.

closely spaced type, independently sprung cams, include dual drives, two-speed drives, centrifugal water pump drives, forced and induced fan drives, and ventilating fan drives in power plants, mines, steel mills, foundries, and other heavy industries.

Tapped holes are provided in both ends of the clutches for attaching sprockets, gears, pulleys, or ratchet arms to meet requirements. The desired direction of rotation is obtained by attaching the component to either side of the clutches.

Circle Item 141 on postcard, page 255

Speed Reducer with Double-Enveloping Gearing

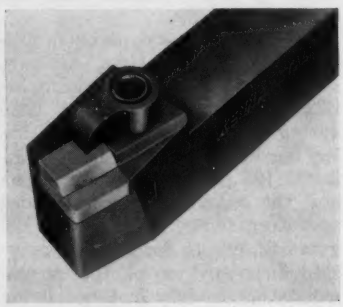
Shaft-mounted speed reducers featuring double-enveloping worm gearing are now available from Cone-Drive Gears, Division of Michigan Tool Co., Detroit, Mich.

Shaft-mounted speed reducer, product of Cone-Drive Gears, Division of Michigan Tool Co.

A right-angle design between input and output shafts offers both application and space-saving advantages. The reducer is mounted directly on the driven shaft and requires only a simple bracket or torque arm to prevent rotation. If a motorized reducer is desired, a bell housing can be furnished to accommodate standard NEMA C-type flanged motors.

These reducers are being manufactured in 2, 2 1/2, and 3-inch center distance sizes, and can be furnished in pinion-under, pinion-over, or vertical shaft models. Loads that can be handled by the three sizes of reducers range from fractional horsepower to 3, 5 1/2, and 9 H.P., respectively.

Circle Item 142 on postcard, page 255



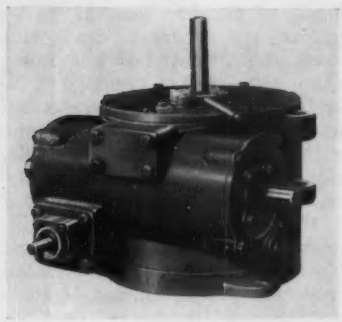
Kendex tool with "throw-away" carbide insert

Tool with "Throw-Away" Carbide Insert

Kennametal Inc., Latrobe, Pa., has just added to its Kendex line a low-cost tool using a "throw-away" tungsten-carbide insert. The insert has as many as eight cutting edges which can be used successively until all are dull or worn out. This eliminates grinding in the user's shop, cuts cost per cutting edge, and provides a new system of chip control.

The tool is provided in two types —Kendex button tools and heavy-duty tools. A removable chip-breaker is used on the button tools, while on the heavy-duty line, a hardened clamp serves as a chip deflector. Button tools with square or triangular tungsten-carbide buttons are available in two finishes: regular, which is molded to size with the nose radii and top and bottom surfaces ground; and precision, which is ground all over for accurate on-the-job indexing.

Circle Item 143 on postcard, page 255



Automatic Cam-Operated Indexing Unit

Cam-operated indexing unit developed by the Standard Tool & Mfg. Co., Lyndhurst, N. J., to provide for precision positioning between automatic production stations or a simplified means of timing production operation drives. Automatic indexing of 8, 12, 16, or 20 divisions can be obtained during a complete cycle. Accurate positioning for such operations as milling, drilling, soldering, or assembling is assured at each position. The unit is 17 inches long, 16 1/2 inches wide, and 13 3/4 inches high.

Circle Item 144 on postcard, page 255

Spiral Hone for Finishing Grooved Bores

Hone with spiral or helical stones that operate efficiently on interrupted surfaces, such as rifle gun bores and longitudinally grooved cylinders. The hone can be operated either automatically or manually. Experimental runs have indicated that stock removal at the rate of 0.002 to 0.005 inch per minute is possible on large bores. Head sizes range from 3 inches upward. Automatic sizing is accomplished either by means of a Sheffield Precisionaire or standard sizing ring. Product of Spiral Hone Corporation, Elmore, Ohio.

Circle Item 145 on postcard, page 255

Brooks Holder for Socket-Head Screw and Nut Wrenches

Holder designed to convert four separate wrenches into a combination hand tool with the ends of four wrenches projecting from the top of the holder in different directions, ready for use. For deep-seated or hard-to-reach screws, the wrench is simply reversed in the holder so that its long end can be used. The holder gives the leverage required for tightening or loosening screws. Made in three models, covering wrench sizes from 0.050 to 7/16 inch, by the Micro Tool Co., Hartford, Conn.

Circle Item 146 on postcard, page 255

Inserted Carbide Blade Milling Cutter

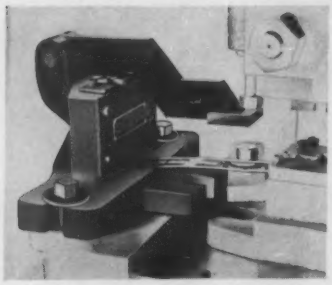
Millit, Inc., Rochester, N. Y., has introduced an inserted solid-carbide blade milling cutter designed for high-production metal removal. Close blade spacing and increased blade strength make it possible to operate this cutter at exceptionally high feed rates. Low replacement blade costs are also a feature of the cutter. The rectangular shaped carbide blades are held in a tapered slot by a round taper-slotted wedge. These shell type cutters can be had with two blade sizes of 5/32 by 1/4 by 1 inch and 1/4 by 3/8 inch by 1 1/2 inches, and in a diameter range of from 2 to 8 inches.

Circle Item 147 on postcard, page 255

Lixie Dual-Purpose Hammer

Dual-purpose hammer of a solid bronze, non-ferrous material brought out by the Lixie Products Co., Providence, R.I. This combination of a machinist's hammer head and a tool-adjusting head in one balanced hammer affords the correct feel needed for precision tool-adjusting and machinist's hammer operations. It is also suited for assembly work and is especially adapted for use in setting up machine tools. The material in the hammer allows it to be used for light tapping without rebound.

Circle Item 148 on postcard, page 255



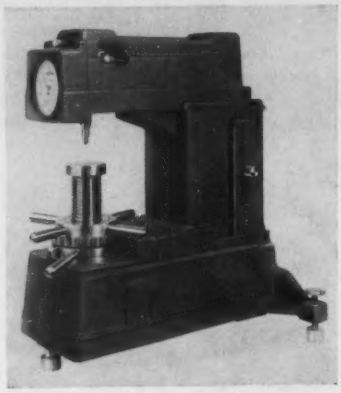
Scrap Chopper for Power Press

Scrap chopper designed for operation by ram of power press. The chopper can be clamped to any press bed and will handle steel up to 3 inches wide and any thickness up to 0.062 inch. It is designed to permit a spare cut-off blade to be installed quickly whenever the one in use needs sharpening. Product of Jaco Devices, Inc., Hingham, Mass.

Circle Item 149 on postcard, page 255

Kentrall Hardness Tester

Kentrall hardness tester that can be used for both regular and superficial Rockwell hardness tests,



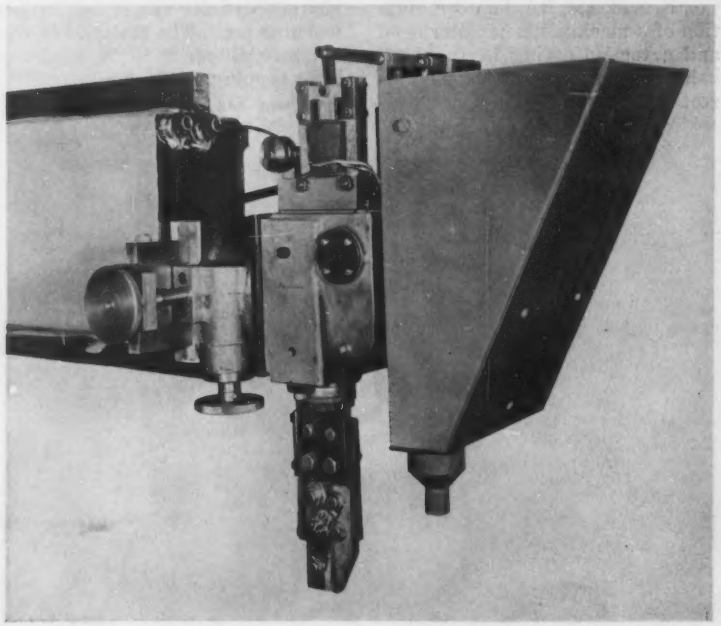
developed and manufactured by the Torsion Balance Co., Clifton, N. J. In its dual function, it makes all regular Rockwell tests with loads of 60, 100, and 150 kilograms; and superficial tests with loads of 15, 30, and 45 kilograms, using any suitable standard C, N, or ball type indenter. Results appear on an easily read dial gage with a single numerical scale. Equipment includes all weights for regular and superficial testing, a 1/16-inch diameter steel ball indenter, four anvils, and eight test blocks. Also available are diamond indenters for A, C, and N scale testing; ball indenters for 1/8-, 1/4-, 1/2-, or 3/4-inch diameter steel balls and special flat or wedge indenters.

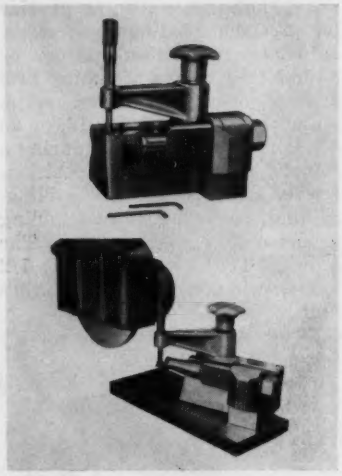
Circle Item 151 on postcard, page 255

Peck Head Mount for Automatic Welding Equipment

"Uneek" head mount available from Cecil C. Peck Co., Cleveland, Ohio, for use with all standard welding heads. This mount is designed to permit lateral movement of the welding head or electrode across the seam as well as angular positioning of the head, either right or left, particularly for fillet welding. Provision is made for pointing or leading the filler wire ahead of the normal downward position, or giving it a backward inclination. The head can also be set in a stationary position at 90 degrees to the normal longitudinal travel for making circumferential welds on tanks, boilers, condensers, and other cylindrical objects.

Circle Item 150 on postcard, page 255





Fixture for Sharpening and Measuring Circular Form Tools

Micrometer grinding fixture for use in making the proper offset adjustment when sharpening circular form tools used in automatic screw machines and recessing tools. This fixture, announced by Scully-Jones & Co., Chicago, Ill., can be used on any tool-room surface grinder having a magnetic chuck, and also on universal type grinders by bolting it to the table. Advantages claimed include faster set-up for grinding and measuring face offset; closer control over tool diameters and angles for accurate work; and more consistent reproduction of flat cutting faces parallel to the center line and square with the sides. After sharpening, the cutter may be set in the machine or recessing tool and used without further checking by cut-and-try methods.

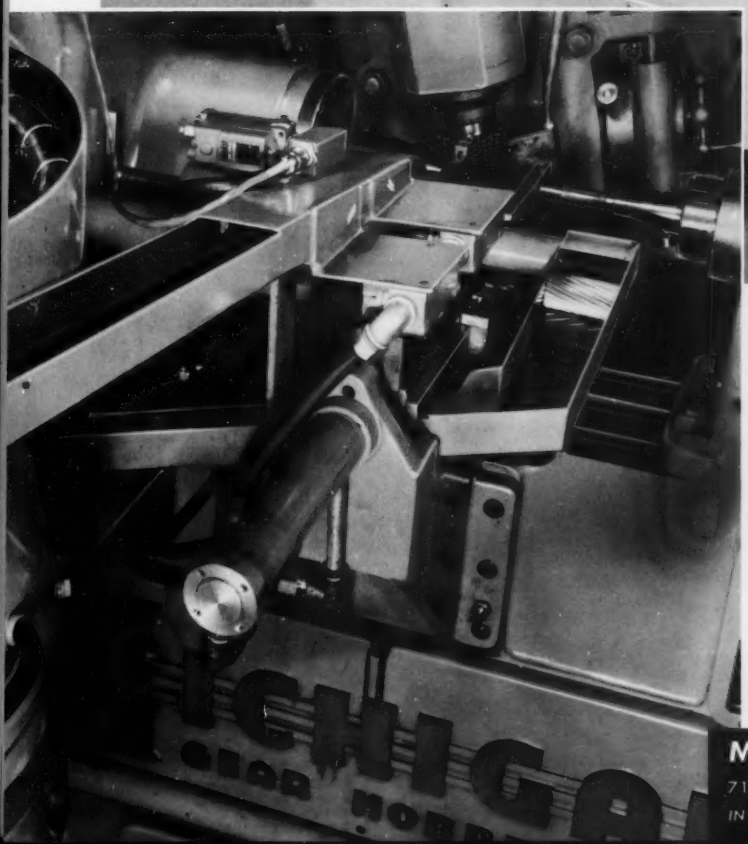
Circle Item 152 on postcard, page 255

(This section continued on page 237)

Announcing

This Month's

GEAR PIX



THE NEW ULTRA-SPEED 5″ GEAR HOBBER

New in principle, this Michigan "Ultra-Speed" No. 1445 hobber hydraulically crossfeeds the hob across the work at the helix angle of the gear. Hydraulic plunge-feed, tail-stock, and hob-shift speed up the hobbing cycle. Fast, simple setup for short runs. Can be equipped with automatic hopper feed for long production runs. Hobs helical or spur gears up to 8 pitch, 4″ face and 5″ diameter at hob speeds up to 570 rpm. Ask for bulletin LH-54.

MICHIGAN TOOL COMPANY

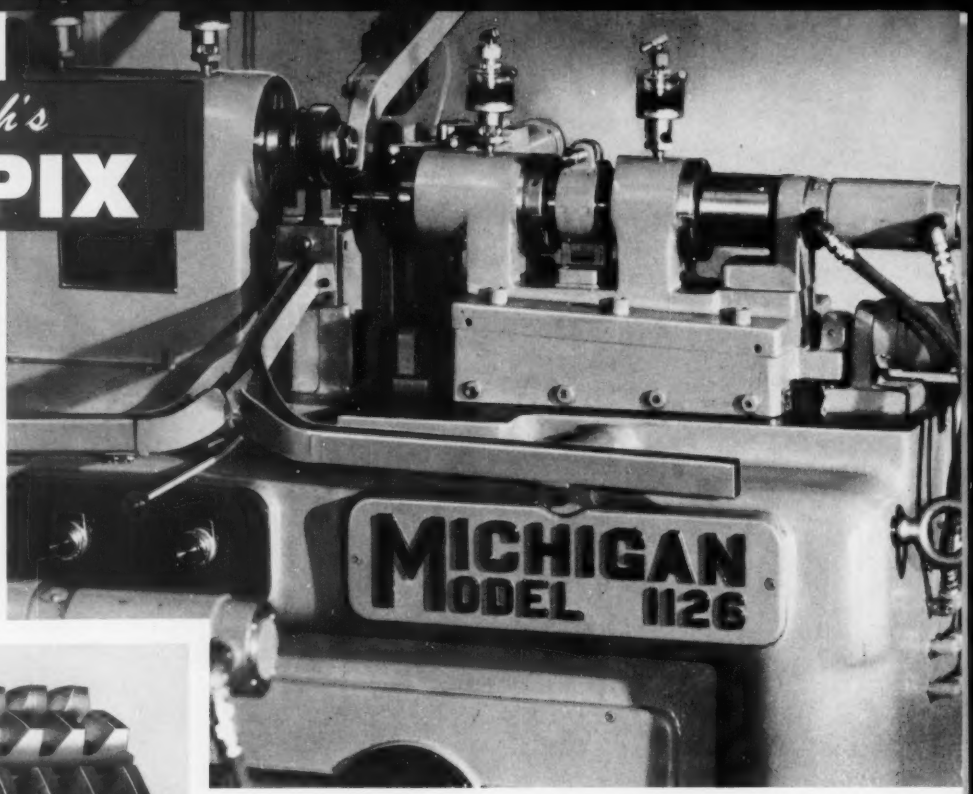
7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD., WINDSOR, ONT.

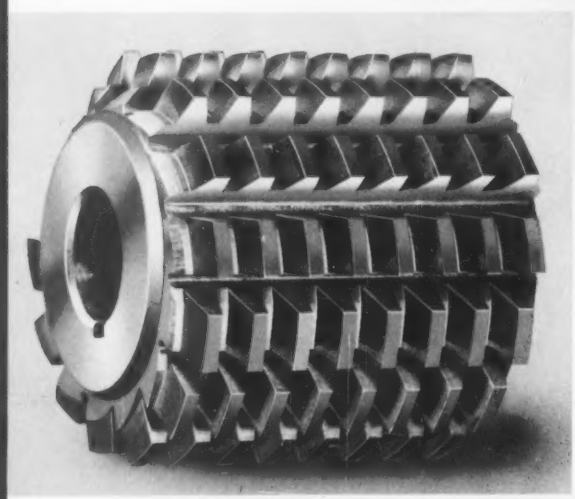
Over

This Month's

GEAR PIX



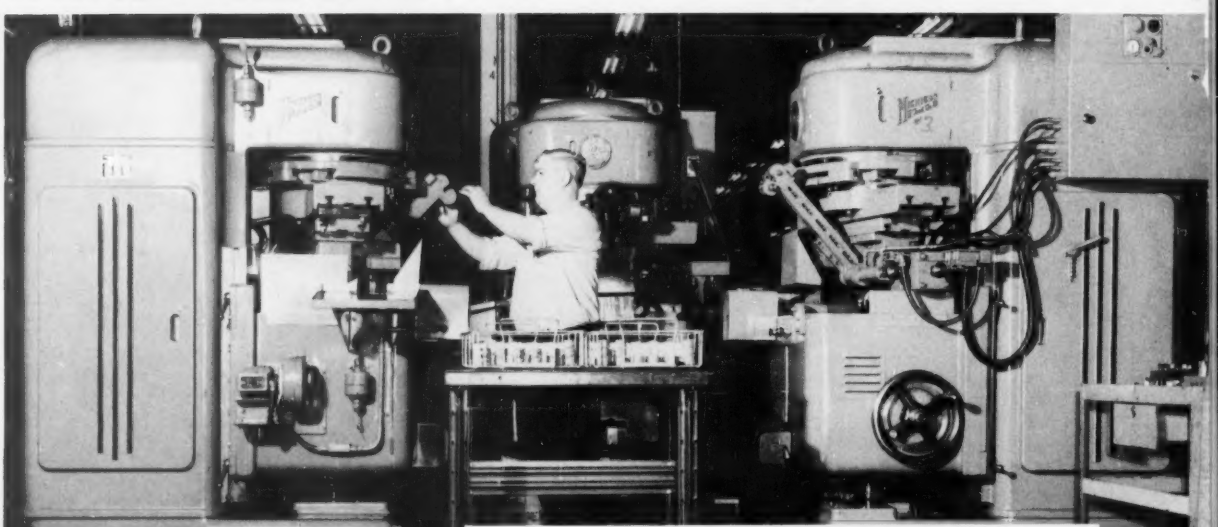
AUTOMATED SPEEDER—The operator just listens to the speeding gear to learn whether it is ok—then flicks the lever to send it down the ok or reject chute. Gears are hopper fed down a chute and automatically loaded and unloaded. Hoppers are mounted behind a soundproof wall.



INCREASE HOB LIFE—Hob life can be increased as much as 225% by reducing the amount of stock that is removed per sharpening.

For instance, a 7 pitch hob where .030″ stock must be removed each time can only be sharpened 12 times. If .020″ stock is removed, it can be sharpened 19 times. But if sharpening requires only .010″ stock to be removed at a time, the 7 pitch hob can be sharpened a total of 38 times.

There are times when it is advantageous to get maximum production between sharpenings, even though it does require excessive stock removal. Each individual case should be decided on its own merits.



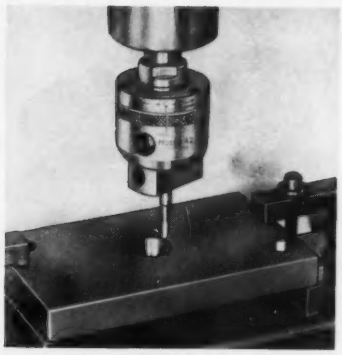
600 PER HOUR—One operator shaves 600 automatic transmission planet gears per hour on three Michigan 870-A automatic gear finishers. Complete cycle, including size checking before shaving is automatic. Gears are 17-tooth, 1.2922″ pitch dia., 1.123″ face, 20° L.H. helix.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD., WINDSOR, ONT.

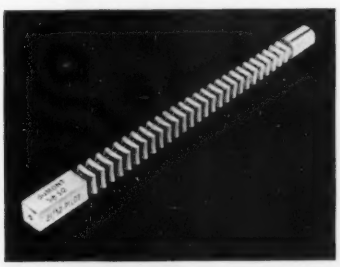
Over



"Deka-Bore" Offset Boring Head

Offset boring head developed by the Precision Tool & Mfg. Co., Cicero, Ill., for economical operation on production runs as well as single-piece work. This "Deka-Bore" tool, as it is called, has two independent means of adjustment. The offset dovetailed tool-holder slide is actuated by the conventional micrometer screw for rough-boring the hole. Backlash is eliminated in the tool-holder slide by pre-loading the gibs to a predetermined pressure. Calibrations on the body of the tool provide means for making independent, direct, and positive adjustments of 0.0001 inch on the diameter.

Circle Item 153 on postcard, page 255



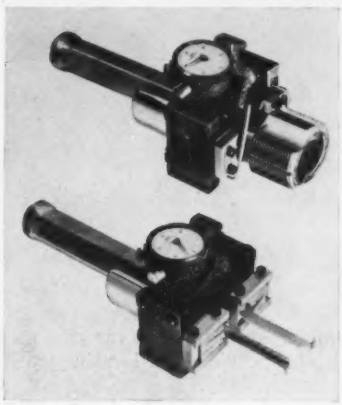
Push Type Square Broach

"Minute Man" high-speed steel, push type square broach brought out by the du Mont Corporation, Greenfield, Mass. Available from stock in eight standard sizes, from 3/16 to 3/4 inch square, manufactured to close tolerances. Starting with a round pilot, these broaches will finish a square hole in a drilled, reamed, or cast bore in one pass. They may be used in either a hand-operated arbor press or a hydraulic press. Square broaches in non-standard sizes and other special rectangular and hexagonal shapes can also be had.

Circle Item 154 on postcard, page 255

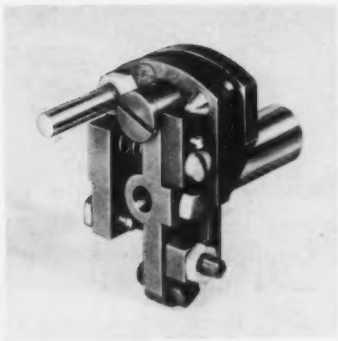
Bryant Gage for Internal Threads and Grooves

Gage with interchangeable segments for checking both internal threads and grooves, made by the Bryant Chucking Grinder Co., Springfield, Vt. This Model P-21 gage is built on the principle of an expanding plug which actuates a precision dial indicator to show the size comparison of the part with respect to a master-setting ring. The gage will check threads from 5/16 inch to 5 inches in diameter at a rapid rate. It also



provides a high-speed method of checking the diameter and roundness of internal grooves.

Circle Item 155 on postcard, page 255



Recessing Tool for Automatic Screw Machines

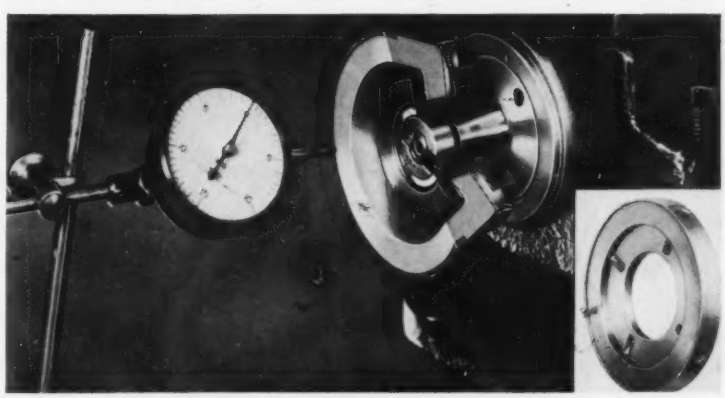
Recessing tool with radial action, brought out by the American Cam Co., Bloomfield, Conn., for use on automatic screw machines. This Model B recessing tool is cam-actuated by the forward motion of the turret and requires no synchronizing of the lead and cross-slide cams. It will perform radial or form recessing, or back-end chamfering without a cross-slide, or swing recessing from a cross-slide, without changes or adaptations. The cutting tool moves radially into the work, making it possible to form recesses that cannot be produced by the conventional recessing tool. The cam action holds close tolerances throughout long runs.

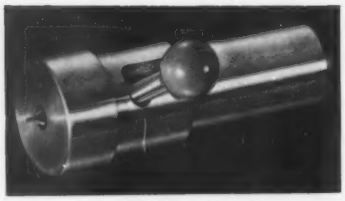
Circle Item 156 on postcard, page 255

"Easy-Tru" Collar for Diamond Wheels

Cut-away view of the "Easy-Tru" collar brought out by the Queen City Carbide Tool Co., Cincinnati, Ohio, for truing diamond wheels speedily. Four accurately machined, cone-point socket head adjusting screws are spaced 90 degrees apart around the collar. A safety band covers these screws during operation. After checking the wheel run-out with a dial indicator, the screw or screws adjacent to the low indicator reading are tightened to throw the wheel face outward at this point so that the indicator shows a uniform reading at all points.

Circle Item 157 on postcard, page 255





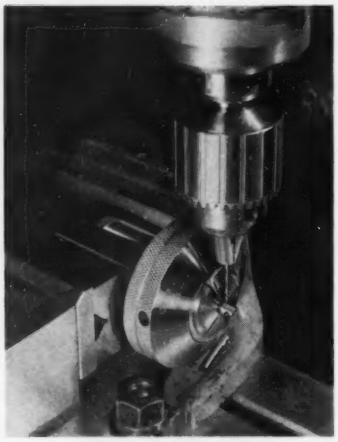
that it cannot dislocate the workpiece as the collet jaws are not drawn in while they are being closed. Can be used on lathes, milling machines, drill presses, dividing heads, super spacers, surface grinders, cylindrical grinders, two-, three-, four-, and six-jaw chucks, or set in a vise at any angle. An adjustable internal stop is also provided for locating workpieces axially.

Circle Item 159 on postcard, page 255

Combination Stock Stop and Center-Drill Holder

Tool for turret lathes, called the "Ident-I-Center," comprising a combination rotary stock stop and center-drill holder with shank to fit hole in turret. A hardened cap on the stop rotates on a ball bearing when it is contacted by the work. For center-drilling, it is only necessary to back up the turret about an inch and shift a lever which brings the center drill into position. The drill is then fed in until the rotary cap of the stop revolves again, indicating that the center is drilled to depth. The tool is available with shanks 1 inch, 1 1/4, 1 1/2, and 1 3/4 inches in diameter. Made by the Schultz Mfg. Co., Cleveland, Ohio.

Circle Item 158 on postcard, page 255



Collet Chuck Designed to Reduce Set-Up Time

A machinist's tool known as the "Chukollet," designed to reduce set-up time and eliminate the need for special tooling, announced by the Hancock Mfg. Co., Inc., Santa Clara, Calif. This work-holding device is precision built of nickel molybdenum steel, and is hardened throughout. It is so constructed

Desmond Holder for Dressing Diamond

Diamond nib holder, designated D-H No. 15, placed on the market by the Desmond-Stephan Mfg. Co., Urbana, Ohio, for use on surface grinders. This holder allows the nib to be brought in contact with the wheel at an angle of 15 degrees to restore the accuracy and cutting action of the grinding wheel. The nib can be turned by hand to maintain a point on the diamond. The holder can be bolted to the table or used on a magnetic chuck. It is made of solid steel, weighs 2 1/2 pounds, and can be used with any size diamond nib on any size grinding wheel.

Circle Item 161 on postcard, page 255

Variable-Speed Stock Straightener

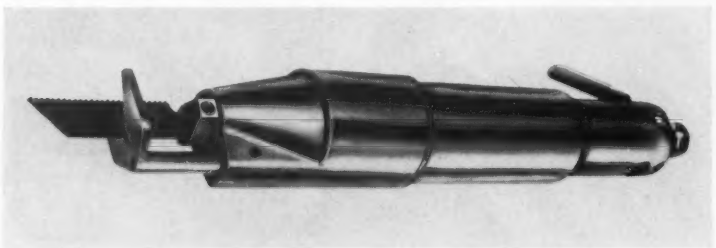
Stock straightener developed by Cooper Weymouth, Inc., Bridgeport, Conn., for use with presses, shears, or slitters, or alone, to straighten small parts and materials. When used in combination with feed-equipped presses, this variable-speed stock straightener will automatically maintain stock in a free loop even though the press is run intermittently. It operates at controlled speeds from 10 to 50 feet per minute. Made in models with five, seven, or nine rolls to handle stock from 2 1/2 to 12 inches in width and up to 1/8 inch in thickness.

Circle Item 162 on postcard, page 255

Pneumatic Filing and Sawing Tool

Pneumatic filing and sawing production line tool brought out by the Chicago Pneumatic Tool Co., New York City. This 5-pound tool cuts every material or shape ordinarily worked by power or hand hacksaws, and drives round shank bench files or flat shank sizes up to 13/16 by 5/32 inch. The saw-blade collet and file chuck are quickly interchangeable. A built-in speed regulator permits selection of the proper speed range for any job. Exhaust air blows cuttings from work area.

Circle Item 160 on postcard, page 255



Ease of Handling

Efficient Performance

4 factors SAVE TIME, here

Photo courtesy of The Peck, Stow & Wilcox Company, Southington, Conn.

Minimum of "Down Time"

No Operator Fatigue

The Peck, Stow & Wilcox Company point out that the general performance, handling, along with reduced operator fatigue and a minimum of down time of this modern Cincinnati Bickford Super Service Radial Drill effected a 20% time saving in their shop.

The illustration shows the drilling of housings for the Pexto Power Shears. Each piece that formerly required 2 hours is now completed in 1½ hours.

Investigate Cincinnati Bickford Drilling machines, profit makers for 80 years.

Write for Bulletin R-29.

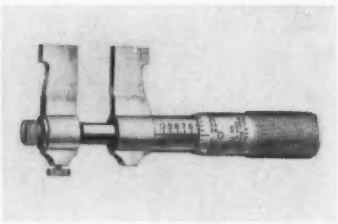
80 YEARS OF SERVICE

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

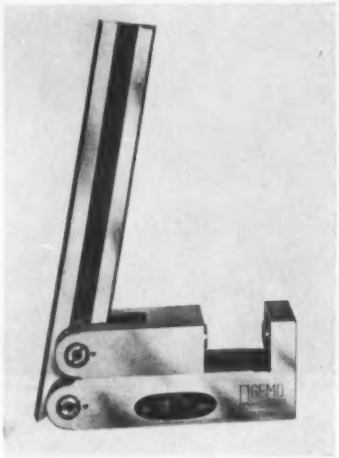
Cincinnati 9, Ohio, U.S.A.



Starrett Inside Micrometer

Inside micrometer caliper developed by the L. S. Starrett Co., Athol, Mass., to combine the convenience and quick-reading features of a micrometer with vernier caliper style jaws in a tool that is compact, well balanced, and easy to use on precision work. It has a range of 1 to 2 inches with 0.001 inch graduations. No-glare satin chrome finish resists stains, corrosion, and rust.

Circle Item 163 on postcard, page 255



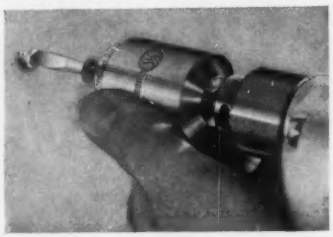
Precision Angle Gage

"Gemo Bevelgauge" for making and checking angular set-ups to plus or minus 1 minute of arc (0.017 degree), announced by the Cleveland Instrument Co., Cleveland, Ohio. This unit is designed for use on machine set-ups in toolrooms and inspection departments, or wherever high-precision angle-measuring is required. The angular setting of the angle bar is determined by the position of the slide along the base. The position of the slide is governed by gage-blocks placed between facing anvils on the slide and base. A standard set of gage-blocks consisting of thirty-seven pieces provides for settings from 0 to 180 degrees in increments of 1 minute of arc.

Circle Item 164 on postcard, page 255

Screwdriver Attachment for Power Drill

Screwdriver attachment brought out by Supreme Products, Inc., Chicago, Ill., to provide a low-cost, high-performance power drill



accessory for sinking wood-screws. The attachment is applied to the drill chuck the same as to a drill bit, and is operated by merely applying pressure to the butt of the power tool. This pressure engages a friction clutch in the attachment and sinks screw. The work is always under control. Attachment is offered in two sizes.

Circle Item 165 on postcard, page 255

"Toolflex" Tool-Holders

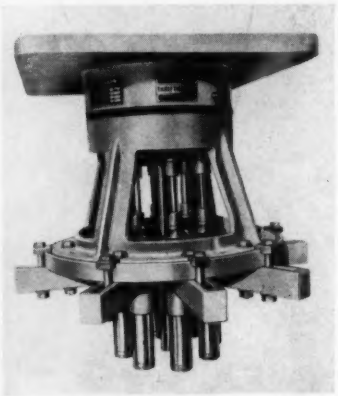
Largest and smallest neoprene-mounted "Toolflex" tool-holders illustrated, now being made by Burg Tool Mfg. Co., Gardena, Calif. The largest one has a bore

diameter of 3 inches. There are forty-eight available sizes ranging down to 1/4 inch in diameter. These tools are designed for heavy work on large boring mills and for work requiring small, close-center, multiple-spindle set-ups. These tool-holders are full-floating and self-centering.

Circle Item 166 on postcard, page 255

Spindle Clamping Device for Thriftmaster Drill Head

A spindle bracket clamping device that makes optional use of spindle locating and locking templates, developed by Thriftmaster Products Corporation, Lancaster, Pa. The device has two clamping bolts for each adjusting bracket and is used with the Thriftmaster nine-spin-



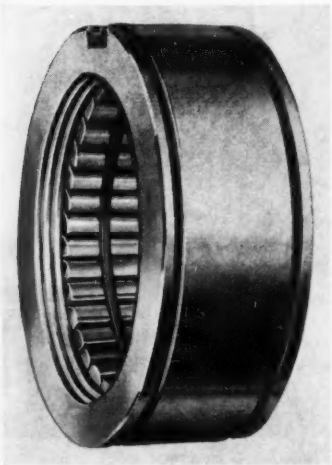
dle, full ball-bearing, universal joint type drill head illustrated.

Circle Item 167 on postcard, page 255

Formsprag Backstop Clutch

New Series 50 backstop clutch announced by the Formsprag Co., Van Dyke, Mich. This unit can be employed to advantage on gear reducing applications where the backstop can be incorporated into a bearing bore and an existing shaft extension can be used for an inner race. Made in sizes having outside diameters ranging from about 1 1/2 to 4 3/4 inches.

Circle Item 168 on postcard, page 255



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WORD OF MOUTH?
It gives you the answer sometimes, but not many of your friends have the same cutting oil requirements and the same problems that you have. It's much surer to depend on specialists like Sun.

LABORATORY ANALYSIS?
Sure. But there's no formula for correlating the laboratory analysis with how well the cutting oil will work on your job. It takes years of field experience like Sun's to help you make the right choice.

ELABORATE SHOP TEST?
This will probably give you the answer. But it's expensive and interferes with production when you try to test all the oils available. Sun's experience can help keep your shop-testing to a minimum.

EXPERIENCE IS THE ANSWER.
And Sun has it. Its field representatives have probably come across problems similar to yours many times. If they haven't, its cutting oil specialists and metallurgical technicians are ready to help with your problem.

Soluble or straight, transparent or black, light or heavy duty — Sun makes the kind of cutting oil you need to handle your job at the lowest cost. For more information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept.

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Micrometer with Indicating Mechanisms for Controlling Measuring Pressure

"Master Compar" indicating micrometer with mechanism for controlling measuring pressure and having a range of from 0 to 1 inch, reading in 0.0001 inch, is announced by the George Scherr Co., Inc., New York City. The indicating mechanism controls the measuring pressure, providing a "visible feel" so that all uncertainties due to differences in the individual's sense of touch or feel are eliminated. The release button for the movable anvil is on the right-hand side of the micrometer, enabling the operator to hold it in the conventional way. Resetting

the instrument to zero is accomplished in less than five seconds by means of a screw on the bottom of the housing. Larger sizes up to 4 inches have removable indicator.

Circle Item 169 on postcard, page 255

Ball-Bearing Trolley for Overhead Conveyors

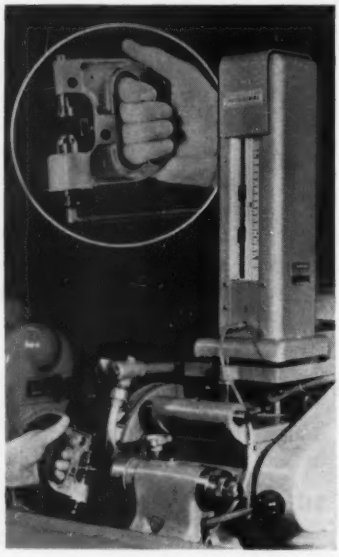
Ball-bearing trolley for overhead conveyors, known as Series 500, developed by the Link-Belt Co., Chicago, Ill. This new trolley is designed to assure rolling contact with the track at all positions. Link-Belt bearings, with ball and cage assembly, and concentrically ground raceways, are used to keep friction at a minimum. The wheels are of steel with treads machined and hardened to give maximum life, and the brackets are of forged steel. A large lubricant storage space and a pressure type grease fitting are provided. There are

three sizes in the series, all interchangeable with trolleys commonly used with rivetless conveyor chain.

Circle Item 170 on postcard, page 255

Sheffield Plunjet Airsnap Gage

Adjustable Plunjet Airsnap gage brought out by the Sheffield Corporation, Dayton, Ohio, for connection to a flow type Precisionaire which provides up to ten times the amplification offered by dial indicator snap gages. Twelve models are available, covering a size range from 0 to 12 inches in 1-inch increments. The Plunjet gaging cartridge is interchangeable, providing a gaging range from 0.001 to 0.080 inch and amplifications from 62.5 to 1 up to 5000 to 1. Sheffield dial indicator

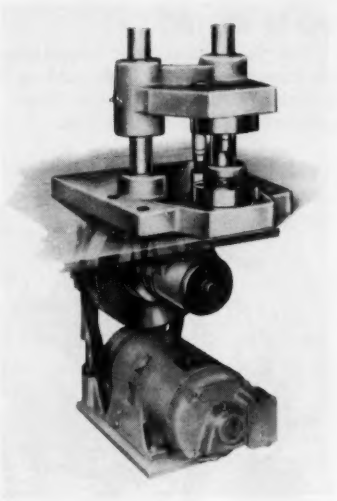


snap gages now in use can be converted into Plunjet Airsnaps by substituting an inexpensive adapter and the proper Plunjet for the dial indicator.

Circle Item 171 on postcard, page 255

Swanson Press Unit

Precision power press called the "Power-Di," announced by Swanson Tool & Machine Products, Inc., Erie, Pa. This 1-ton press is designed to reduce tooling costs, since punches and dies of any shape may be mounted in simple retainers which are automatically aligned in the opposing ram and bolster members. The compact design makes it practical to arrange several presses in series for simul-



taneous piercing, notching, or forming operations on large sheets. Available as a bench or pedestal press with a stroke of 1 1/4 inches, shut height of 3 to 6 inches, and speed of 200 strokes per minute.

Circle Item 172 on postcard, page 255

* * *

Hardinge Variable-Speed Lathe—Correction

The capacity of the collet furnished with the new DV59 lathe brought out by Hardinge Brothers, Inc., Elmira, N. Y., was incorrectly given as 11/16 inch in a description of the machine published in December MACHINERY, pages 236 and 237. The correct work-holding capacity of the DV59 lathe fitted with the new 5C Hardinge collet is 1 1/16 inches.

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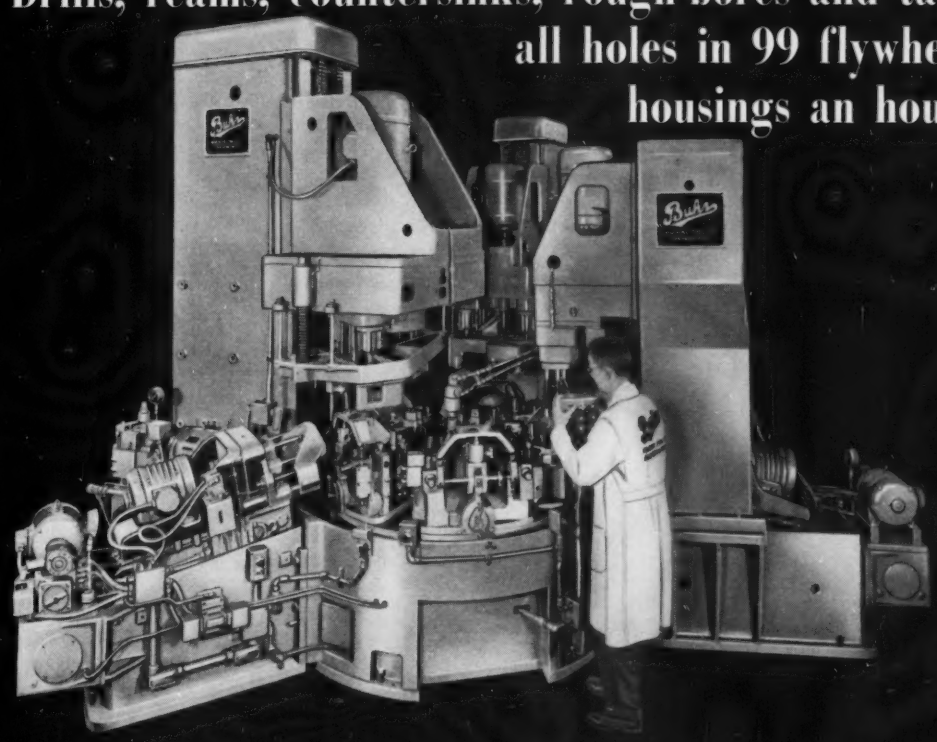
Drills, reams, countersinks, rough-bores and taps all holes in 99 flywheel housings an hour!

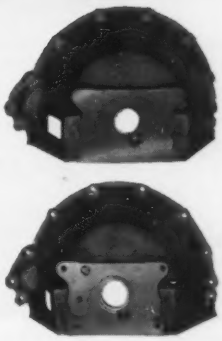


And it performs 42 operations on each part!

That's the 80%-efficiency production rate of this Buhr Special 5-way dial-type hydraulic-feed drilling and individual-lead-screw tapping machine.

Equipped with 60″-diameter 5-station power-operated automatic index table with shot bolt . . . Automatic hydraulic power clamping on fixtures.

Parts of this Buhr Special, all held to tolerances, are completely interchangeable — all component assemblies located by precision-bored dowels — standard Buhr manufacturing technique.



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For more information on products advertised, use Inquiry Card, page 255

AMERICAN STANDARD BUTTRESS SCREW THREADS—2

The buttress form of thread has certain advantages in applications involving exceptionally high stresses in one direction only, along the thread axis. As the thrust side of the thread is made very nearly perpendicular to the thread axis, the radial component of the thrust is reduced to a minimum. On account of the small radial thrust, this form of thread is particularly applicable where tubular members are screwed together. Examples of actual applications are the breech mechanisms of large guns and airplane propeller hubs.

As the use of buttress threads applies mainly to specially designed components, it has been considered that no useful purpose would be served by introducing a recommended diameter-pitch series.

In selecting the form of thread recommended as standard, manufacture by the thread milling or grinding process has been taken into consideration. Whenever possible, it is recommended that the form of thread and tolerances contained in this standard be used.

1. Scope—This standard relates to screw threads of buttress form and provides:

(a) A standard form of thread;

(b) Tables of preferred diameters and preferred pitches;

(c) A formula for calculating pitch (effective) diameter tolerances;

(d) Tolerances for major and minor diameters;

(e) A system of allowances between mating parts;

(f) Recommended methods of gaging.

2. Definitions—For the purpose of this standard the contacting flank of the thread which takes the thrust is referred to as the "pressure flank," and the clearance flank as the "trailing flank."

3. Basic Form of Thread—The basic form of the buttress thread is shown in Fig. 1,* and has the following characteristics:

(a) A pressure flank angle, measured in an axial plane, of 7 degrees from the normal to the axis;

(b) A trailing flank angle, measured in an axial plane, of 45 degrees;

(c) Equal truncations at the crests of the internal and external threads, so that the basic depth of engagement (assuming no allowance) is equal to 0.6 of the pitch;

(d) Equal radii at the roots of the internal and external threads, tangential to the pressure flank and the trailing flank.

4. Preferred Diameter Series—It is recommended that the nominal major diameters of buttress threads be selected, whenever possible, from the following geometric (20) series:

Preferred Nominal Major Diameters, Inches

1/2	1 1/8	2 1/2	5 1/2	12
9/16	1 1/4	2 3/4	6	14
5/8	1 3/8	3	7	16
11/16	1 1/2	3 1/2	8	18
3/4	1 3/4	4	9	20
7/8	2	4 1/2	10	22
1	2 1/4	5	11	24

5. Preferred Pitch Series—It is recommended that the pitches of buttress threads be selected from the following geometric (10) series:

Preferred Number of Threads per Inch

20	6	2
16	5	1 1/2
12	4	1 1/4
10	3	1
8	2 1/2	

6. Tolerances—Tolerances on external threads shall be minus, and on internal threads, plus.

(a) TOLERANCES ON PITCH (EFFECTIVE) DIAMETER—The following formula is for determining pitch diameter tolerances:

Class 2 (Medium) Pitch (Effective) Diameter

$$\text{Pitch diameter tolerance} = 0.002\sqrt[3]{D} + 0.00278\sqrt{L_e} + 0.00854\sqrt{p}$$

where

D = major diameter of thread;
L_e = length of engagement;
p = pitch of thread

It is to be borne in mind that this formula relates specifically to Class 2 (medium) tolerances. Class 3 (close) tolerances are 2/3 of Class 2 (medium) tolerances, and Class 1 (free) tolerances are 1 1/2 times Class 2 (medium) tolerances.

If the length of engagement is taken as $10p$, the formula can be further simplified to:

$$0.002\sqrt[3]{D} + 0.0173\sqrt{p}$$

Using this formula, pitch (effective) diameter tolerances for various combinations of pitch and diameter are given in Tables 2, 3, and 4.†

(b) TOLERANCES ON MAJOR DIAMETER OF EXTERNAL THREAD AND MINOR DIAMETER OF INTERNAL THREAD—As each of these diameters may be used as a datum for measurement of thread angles and pitch they should be held to close limits, see Tables 2, 3, and 4.

(c) TOLERANCES ON MINOR DIAMETER OF EXTERNAL THREAD AND MAJOR DIAMETER OF INTERNAL THREAD—It will be sufficient in most instances to state only the maximum minor diameter of the external thread and the minimum major diameter of the internal thread without any tolerance. However, the root truncation from a sharp V should not be greater than $0.0826p$ nor less than $0.0413p$.

* See December, 1954, MACHINERY.
† To be published in succeeding issues of MACHINERY.

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MACHINERY'S DATA SHEET

AMERICAN STANDARD BUTTRESS SCREW THREADS—3

7. Minimum Clearances for Easy Assembly—An allowance (clearance) should be provided on all buttress external threads in order to secure easy assembly of parts. The amount of the allowance should be deducted from the nominal major, pitch (effective), and minor diameters of the external member in order to determine the maximum metal condition.

The minimum internal thread diameters will be basic.

The recommended allowance is the same for all three classes of fit, and is equal to the Class 3 (close) pitch (effective) diameter tolerance as calculated under paragraph 6 (a) in preceding data sheet. The allowances for various combinations of pitch and diameter are given in Table 5.*

The disposition of allowances and tolerances is indicated in Fig. 2.†

Example—2.080-inch, 4 threads per inch, Class 2 buttress thread

h = basic thread height = 0.1500 inch (Table 1 in December, 1954, Data Sheet);
$h_n = h_s$ = height of thread in "nut" (internal thread) and "screw" (external thread) = $0.66271p = 0.1657$ inch (Table 1);
G = pitch diameter allowance = 0.0074 inch (Table 5);
Tolerance on pitch diameter of both external and internal thread = 0.0112 inch (Table 3)*
Tolerance on major diameter of external and minor diameter of internal thread = 0.005 inch (Table 3)

Internal Thread (Nut or Tapped Hole)

Basic major diameter = $D = 2.0800$ inches
Minimum pitch diameter = $D - h = 1.9300$ inches
Maximum pitch diameter = $D - h$ + pitch diameter tolerance = 1.9412 inches
Minimum minor diameter = $D - 2h = 1.7800$ inches
Maximum minor diameter = $D - 2h$ + minor diameter tolerance = 1.7850 inches
Minimum major diameter = $D - 2h + 2h_n$ = 2.1114 inches

External Thread (Screw)

Maximum major diameter = $D - G = 2.0726$ inches
Minimum major diameter = $D - G$ − major diameter tolerance = 2.0676 inches
Maximum pitch diameter = $D - h - G = 1.9226$ inches
Minimum pitch diameter = $D - h - G$ − pitch diameter tolerance = 1.9114 inches
Maximum minor diameter = $D - G - 2h_s$ = 1.7412 inches

8. Identification of Leading Flank—In specifying or ordering product, threading tools, or gages with buttress threads, it is important to clearly indicate if the pressure flank (7 degrees) or the trailing flank (45 degrees) is the leading flank. The leading flank is the one which, when the thread is about to be assembled with a mating thread, faces the mating thread. If a buttress screw is designed to push, the pressure flank will be the leading flank on both screw and nut, and if designed to pull, the trailing flank will be the leading flank.

9. Thread Designations—The following abbreviations and symbols are recommended for use on drawings, tools, gages, and in specifications:

N. BUTT = National Buttress thread of form specified in this standard;
(← indicating that internal member (screw) is to push; pressure flank of thread the leading flank;
←(indicating that internal member (screw) is to pull; trailing flank of thread the leading flank;
L. H. indicating a left-hand thread; no symbol is used to indicate a right-hand thread;
p=pitch;
L=lead.

The complete symbol for indicating a particular size of buttress thread shall consist of the nominal diameter (basic major diameter of the internal thread), the symbol indicating if screw is to push or pull, the abbreviation N. BUTT, and finally the class number.

If the thread is multiple start, both the lead and pitch should be shown instead of the number of threads per inch.

Examples—

5/8 − 20 (← N. BUTT − 1
indicating a basic major diameter of 5/8 inch, 20 threads per inch, internal member or screw to push, National Buttress form of thread, Class 1, right-hand.

4 − 8 ←(N. BUTT − 2 L. H.
indicating a basic major diameter of 4 inches, 8 threads per inch, internal member or screw to pull, National Buttress form of thread, Class 2, left-hand.

10 − 0.1p − 0.2L (← N. BUTT − 1
indicating a basic major diameter of 10 inches, double thread, pitch 0.1 inch, lead 0.2 inch, internal member to push, National Buttress form of thread, Class 1, right-hand.

* To be published in a succeeding Data Sheet in MACHINERY.
† To be published in a succeeding Data Sheet in MACHINERY.

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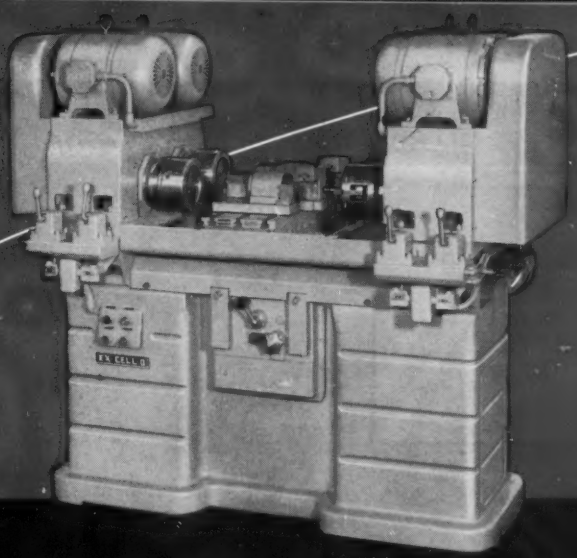

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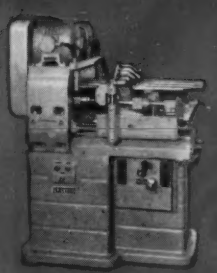

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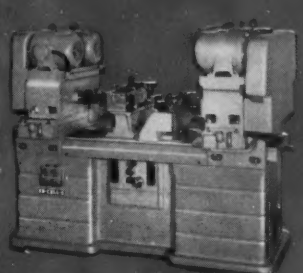

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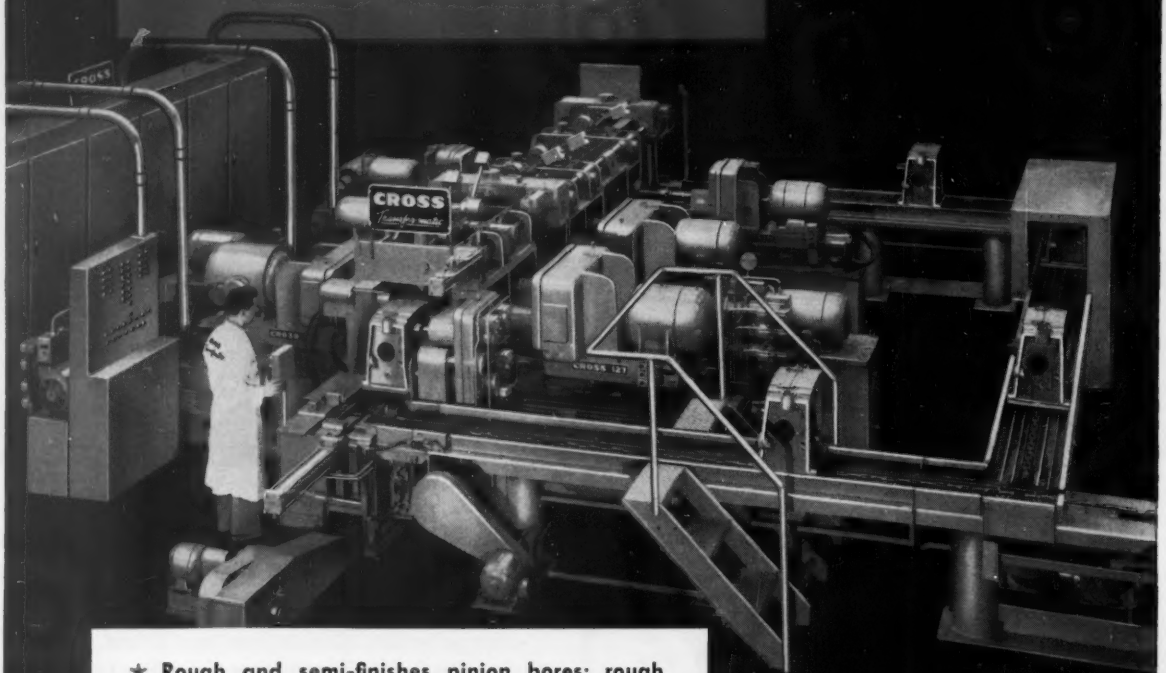
54-2

Another Transfer-matic by Cross

Machines Rear Axle Differential Gear Housings



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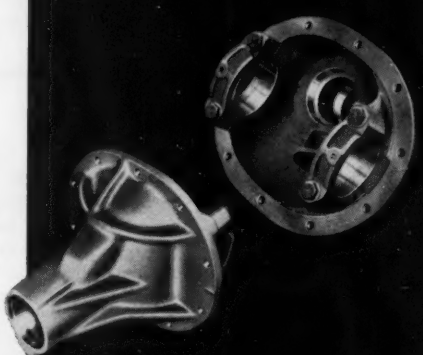
- ★ 9 stations—1 for loading, 4 for boring, 1 for tapping, 2 for indexing, 1 for visual inspection.
- ★ Pallet-type work holding fixtures.
- ★ Hydraulic power wrench for clamping parts.
- ★ Automatic transfer of fixtures from station to station.
- ★ Other features: Complete interchangeability of all standard and special parts for easy maintenance; construction to J.I.C. standards; hardened and ground ways; tandem drive for locating pins; hydraulic feed and rapid traverse; automatic lubrication; oil-mist lubrication for taps; drag-chain type chip conveyor.



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For more information on products advertised, use Inquiry Card, page 255

Between Grinds

By E. S. Salichs

Cramming the Caravan

City buildings do change in character and the one in which The Industrial Press, publisher of MACHINERY, is housed is no exception. So after forty-four years here (of our sixty-year existence), we aim to move this month. From 148 Lafayette Street to 93 Worth Street, New York 13, N. Y.—within walking distance. Perhaps that angle shouldn't be mentioned, upon looking at our personal accumulations. But we are reminded of a town library which recently moved very easily by asking each holder of a library card to take out eight books and return them to the new location. Who would like to borrow from our files?

Partisan Pachyderm

Immediately after Election Day last fall, we heard a story about one of the keepers of an elephant house over at the Brooklyn Zoo. He was chatting with a fellow keeper while cleaning the cage when an elephant hauled off with his trunk, sending him into the moat. On emerging, the keeper said in an aggrieved voice, "All I was saying was that it looked as though the Republicans were losing some seats in Congress."

Gravity Meets Travesty

Dr. Albert Einstein, physicist, recently made the statement, as you will recall, "If I had to do it over again, I would be a plumber." Whereupon a manufacturer of plumbers' pipe tools sent him a kit containing four.

In a Factory Garden

Tired of chopping down weeds behind the plant last summer, the factory manager of the Emerol Mfg. Co. got the idea of starting a garden. Together with the maintenance man, they converted the waste area into a veritable vegetableland, the harvest being shared by all the employes. A trip for a tomato also proved popular at lunchtime.

Ah, Post Office in Paris

A representative doing preliminary research on an automatic tube system in the Paris post office, which operates a 145-station installation, brought back a favorable report to the Timken Roller Bearing Co. The central terminal desk in the Canton plant, where messages were apt to pile up, has been abolished; now the sender simply dials a station number and zing within a minute the carrier containing his message reaches its destination.

Casual about Cash

Notice of a manual just crossed our desk, the price being glossed over in this manner: "At a nominal charge of $3."

NO RIDERS ALLOWED?—This young lady, a recent contestant on Herb Shriner's TV show, was asked the usual question, "What do you do?" She replied, "I drive a Clark fork truck." "Where?" "At Morrison Steel Products, Inc., in Buffalo." Well, Clark (the company) *never knew* that such an attractive operator might be at the wheel of one of its shop trucks, and was somewhat dubious. So Clark (the company) contacted Morrison (the company) and C. A. Stahlka (the Morrison advertising manager) provided this picture to prove that Miss Betty Rohauer does what she said she did!

News OF THE INDUSTRY

California and Washington

THE CARBORUNDUM CO., Niagara Falls, N. Y., has reorganized its sales and engineering services in the West into a Pacific District, with JOHN G. FRITZINGER as manager. Mr. Fritzinger was formerly a sales executive at Niagara Falls. Headquarters for the district, which includes the area west of the Rockies, will be at two new warehouses and office buildings: 2626 S. Malt Ave., Los Angeles, Calif.; and Alviso Road and Evelyn Ave., Mountain View, Calif. (near San Francisco). Mr. Fritzinger will be at the Los Angeles office, which will also be headquarters for W. H. HOMEYER, sales manager, merchandising; W. B. SUMMERS, sales manager for coated products; and WILFRED ROBSON, office manager. F. J. BLAKE, sales manager for bonded products and grain, will be located at the Mountain View office; and JAMES MEEHAN will be office manager there. This organization will provide a coordinated program of all divisions of the company: Bonded Products and Grain Division; Coated Products Division; Refractories Division; Globar Division; and Stupakoff Ceramic and Manufacturing Division.

WALDES KOHINOOR, INC., Long Island City, N. Y., has appointed the Bearing Engineering Co. of San Francisco and Oakland, Calif., as distributor for Waldes Truarc retaining rings and other products in northern California. The West Coast firm, which succeeds the Bearing Specialty Co. of San Francisco as Waldes distributor in the area, will service California manufacturers in, and north of, the counties of Mono, Fresno, and Monterey. In addition to the retaining rings, the distributor will handle Truarc grooving tools, pliers, applicators, and dispensers, from its main office and warehouse at 1547 Mission St. in San Francisco. S. E. SEAGREN is head of the rompany; its branch office, located at 1019 Harrison St., Oakland, is under the supervision of S. E. SEAGREN, JR.

RICHARD T. MYER has been appointed chief metallurgist of the aluminum fabrication division of the Kaiser Aluminum & Chemical Corporation, Oakland, Calif. In this newly created position, Mr. Myer will coordinate metallurgical activities in the fabrication division. He was formerly chief metallurgist at the Massena Works of the Aluminum Co. of America.

SERVOMECHANISMS, INC., Garden City, N. Y., has constructed a new building for its Western Division at 12500 S. Aviation Blvd. at the International Airport, Los Angeles, Calif. This building will replace five smaller buildings now being used by the company at El Segundo.

ROBERT M. SIMPSON has become manager of the San Francisco, Calif., sales branch of the Crucible Steel Company of America, Pittsburgh, Pa., succeeding the late H. G. Bain. Mr. Simpson was previously assistant manager there. With the Crucible company since 1941, he has held various metallurgical positions.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., steel distributor, announces that the Seattle, Wash., plant will now market its stock of alloy steels under the company's certified alloy steel plan.

Illinois and Indiana

VICKERS, INC., Detroit, Mich., has expanded its Brookfield, Ill., sales office to include responsibility for its branches in Tulsa, Okla., and Minneapolis, Minn. CHESTER F. LENIK will be in charge of the Minneapolis branch office as an application engineer; while ALAN R. WICKHAM will manage the Tulsa office in the same capacity. JAMES W. KELLEY, who was formerly at Tulsa, is joining the Brookfield staff as an application engineer.

RALPH B. BILLINGHAM, JR., has been named sales manager of the Automation Section of the W. F. & John Barnes Co., Rockford, Ill. Mr. Billingham joined the company in 1947 as a design engineer of automation equipment, later became a sales engineer and, more recently, was promoted to assistant sales manager in this section.

A.I.T. DIAMOND TOOL CO., Chicago, Ill., has recently moved to a suburb of Chicago, and will be located at 8221 N. Kimball Ave., Skokie, Ill.

LESTER G. WEIDLER, a tool engineer, has become associated with the Wesson Co., Detroit, Mich., manufacturer of carbide cutting tools, joining the sales engineering staff of the Indianapolis district. His mailing address will be Box 264, RR No. 2, Bridgeport, Ind. Mr. Weidler was formerly a machine and tool procurement supervisor in the Marion Mfg. Division of the Dana Corporation.

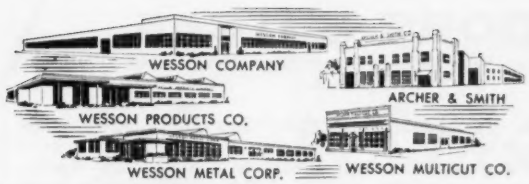
THEODORE H. BOURGUIGNON, assistant manager of the Hallowell Division of the Standard Pressed Steel Co., Jenkintown, Pa., has been named to the company's sales force in the Midwest. He will have his headquarters in Indianapolis, Ind., and cover southern Indiana, southwestern Ohio, and Kentucky.

Michigan, Minnesota, and Wisconsin

CARBOLOY DEPARTMENT of General Electric Co., Detroit, Mich., has added two engineers to its newly formed vacuum-melted alloys section: DONALD K. MINER, formerly a jet-engine materials engineer at the Evendale, Ohio, Aircraft Gas Turbine Division; and J. DAVID BENEDICT, who was with Carboloy Department's permanent magnet operations. Also announced was the appointment of MAX E. HARTL as manager of magnetic materials sales, with headquarters in Detroit. He was formerly Atlantic district magnetic materials representative, a position which will now be filled by W. S. GRIPMAN, who was formerly in the Detroit office. Mr. Hartl succeeds E. L. HUBBARD, who has now been assigned to develop magnet sales on the West Coast. Mr. Hubbard will make his headquarters in Los Angeles, Calif. J. C. BETTS has been transferred from Detroit to the East Central district office in Cleveland, Ohio.

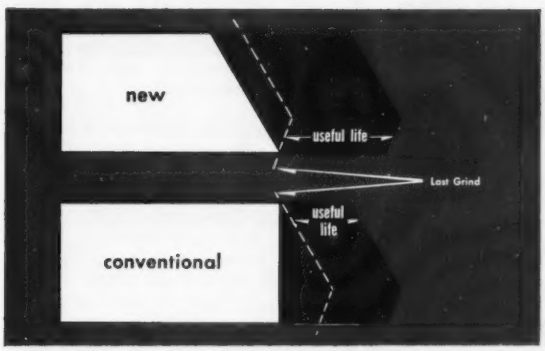
VALENITE METALS CORPORATION is a newly formed concern which will manufacture cemented tungsten-carbide tools and blanks under the trade name "Valenite." A building has already been erected at 31100 Stephenson Highway, Royal Oak, Mich., and pilot runs of the material produced. The corporation's mailing address is Box 205, Royal Oak. ELETOR KOTWICK is president.

ACE TOOL & DIE CO., Detroit, Mich., announces a change of name to ACE TOOL & MACHINE CO. The



carbide NEWS

Carbide Tip Waste Cut 30%



Wesson milling cutter blade design has base parallel with peripheral cutting edge; permits more regrinds per blade

Reduction in carbide waste is assured by the new milling cutter blade, at top, since base of carbide tip parallels the peripheral cutting edge. Conventional blade is shown below.

A new carbide-tipped milling cutter blade design now incorporated into the Wesson Rigidicut milling cutter line is producing an increase of 30% or more in blade life.

Tipped with Wessonmetal carbides, the new blade permits maximum carbide usage and enables many more regrinds per blade.

The new blade design is compared with old style blades in the sketch at the left. In the new blade, the base of the carbide tip is parallel with the peripheral cutting edge, eliminating waste.

Because of the success of the new design in extensive field application tests, it is now standard in most Rigidicut cutters in the fine pitch and coarse pitch series. Additional economy results since these blades are being made available at no increase in price.

Complete engineering data and price information on the entire Rigidicut milling cutter series is available from Wesson Company, Dept. AD, 1220 Woodward Heights Blvd., Detroit 20, Michigan.

Wesson Metal Now In Top 3

With the official opening recently of a new and modern carbide plant in Lexington, Ky., Wesson Metal Corporation entered the ranks of the three largest carbide manufacturers in this country. A model of scientific design, the new Wessonmetal plant occupies over 40,000 square feet of manufacturing space.

In the new plant, greatly expanded research and development facilities will highlight continued development of new carbide metal-cutting grades. The company's quality control laboratories contain some of the most advanced scientific equipment available.

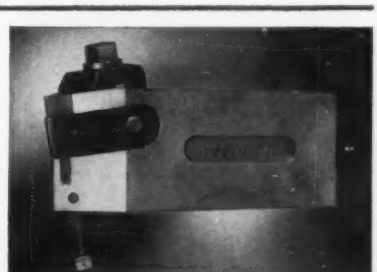
The new plant, which houses some entirely new manufacturing and quality control developments, will more than double the productive capacity of previous facilities. Working at virtually full capacity already, the new plant is keeping pace with wide-spread demand for the complete line of Wessonmetal carbides.

A substantial portion of the plant's capacity is being devoted to output of the latest Wessonmetal development in steel cutting grades. The new steel cutting grade promises to be the most significant carbide development since the introduction of steel cutting carbides.

New Multicut Holder Gets Peak Efficiency From Fischer Lathes

Popularity of the Fischer copying lathe springboarded the development of a special band-type Multicut tool holder. Coupled with the steel band used on all Multicut holders is a new top clamp that assures rigidity of insert when the tool is recessing or going through the out-facing cycle.

Combination of band and clamp permits closer tolerances and finer finishes in the complete range of Fischer lathe applications. Finish turning is eliminated in many operations. The holder uses standard Wessonmetal D-55 inserts.



Closer tolerances and finer finishes result from band and clamp used in Multicut holder.

CARBIDE DATA

Additional information and specifications available:

☐ 121 page catalog covering complete standard and special Rigidicut milling cutter and blade line.

☐ Specification-Data Sheet on special Multicut holder.

Get data by writing to:
WESSON COMPANY, Dept. AD,
1220 Woodward Heights Blvd.
Detroit 20, Michigan

tools Wesson carbide Wessonmetal

company produces special automatic machinery and supporting tooling. THEODORE C. KOCH has been promoted to vice-president and general manager, while MICHAEL TOLLE and L. V. HARDING have become vice-president in charge of sales and vice-president in charge of engineering, respectively. Mr. Harding was formerly with the Cross Company.

BARNES DRILL CO., Rockford, Ill., has opened a sales office in Detroit to serve that area and eastern Michigan. The office, located at 3419 S. Telegraph Road, Dearborn, Mich., will be managed by C. O. HOLLAND, assisted by HILL NELSON, CURT KAHLER, JACK GAMRATH, R. W. LOSEY, and R. M. PALMER.

CARL J. OXFORD, chief engineer and a director of the National Twist Drill & Tool Co., Rochester, Mich., has been appointed vice-president in charge of engineering. Mr. Oxford is active in several metal-working societies and is also the author of technical articles.

MICHIGAN TOOL CO., Detroit, Mich., announces the following executive promotions: A. D. MONCRIEFF becomes manager of the machine tool and cutting tool divisions; CLAYTON E. SCOTT, chief engineer; and CHARLES R. STAUB, staff consultant. Mr. Moncrieff joined the company in 1933 and ten years later became assistant chief engineer, serving in this capacity until last year when he was assigned to the special executive staff. He will now be in charge of engineering and manufacturing for the machine tool and cutting tool divisions. Mr. Scott, who has been with the company since 1935, was assistant chief engineer at the time of his promotion. Mr. Staub joined Michigan Tool in 1929 and has pioneered in the development of modern gear production methods and machines. He has been chief engineer since 1936.

J. F. MCROBERTS, assistant to the president of the Progressive Welder Sales Co., Detroit, Mich., has been named vice-president and general manager.

DONALD C. BUECKER, who recently joined the Standard Pressed Steel Co., Jenkintown, Pa., has been assigned to the Minneapolis office, covering all of Minnesota and western Wisconsin.

LESTER J. LAMACK has been named sales manager of Dumore Precision Tools, Racine, Wis., while GEORGE B. MCMANNERS has been made advertising manager. HERB AINSWORTH has been appointed district sales manager at the Detroit, Mich., office.

New England

AMERICAN RESEARCH CORPORATION, Bristol, Conn., has announced the completion of an addition to its plant, thereby increasing its manufacturing floor space by 70 per cent. The company produces environmental test equipment, but also plans to promote its temperature, humidity, and altitude equipment.

PRINTED CIRCUITS, INC., is a newly formed company for the design, engineering, and manufacture of all types of printed circuit boards, at 36 Tunxis Ave., Bloomfield, Conn. ERNEST E. CARPENTER is president; and CHAUNCEY T. MITCHELL is general manager of production and engineering.

HICKS B. WALDRON has been named materials specialist of the General Electric Co.'s Distribution Assemblies Department, Plainville, Conn.

REED-PRENTICE CORPORATION, Worcester, Mass., newly acquired subsidiary of the Package Machinery Co., will have the following slate of officers: ROE S. CLARK, president of Package Machinery Co., will be chairman of the board; ROGER L. PUTNAM, president; FREDERICK W. MCINTYRE, JR., vice-president in charge of sales; and JACKSON R. HOLDEN, secretary and clerk. Continuing in their respective positions are DONALD H. DALBECK, vice-president and treasurer; and IVER G. FREEMAN, vice-president.

JAMES M. ROBINSON has been appointed assistant manager of the Springfield, Mass., sales branch of the Crucible Steel Company of America, Pittsburgh, Pa. Mr. Robinson joined Crucible in 1936, and has been associated with the Springfield office since 1939.

WIGGLESWORTH MACHINERY CO. recently moved from its Cambridge location to 60 Border St., East Boston, Mass.

New York

GENERAL ELECTRIC CO., Schenectady, N. Y., recently announced the formation of the Distribution Group, which will be composed of the Apparatus Sales Division, the General Electric Supply Co., the International General Electric Co., and the General Electric Credit Corporation. The Affiliated and Foreign Companies Group is discontinued. HENRY V. ERBEN, executive vice-president, has

(*Continued on page* 260)

(Left to Right) A. D. Moncrieff, manager of the machine tool and cutting tool divisions of the Michigan Tool Co.; Clayton E. Scott, chief engineer; and Charles R. Staub, staff consultant

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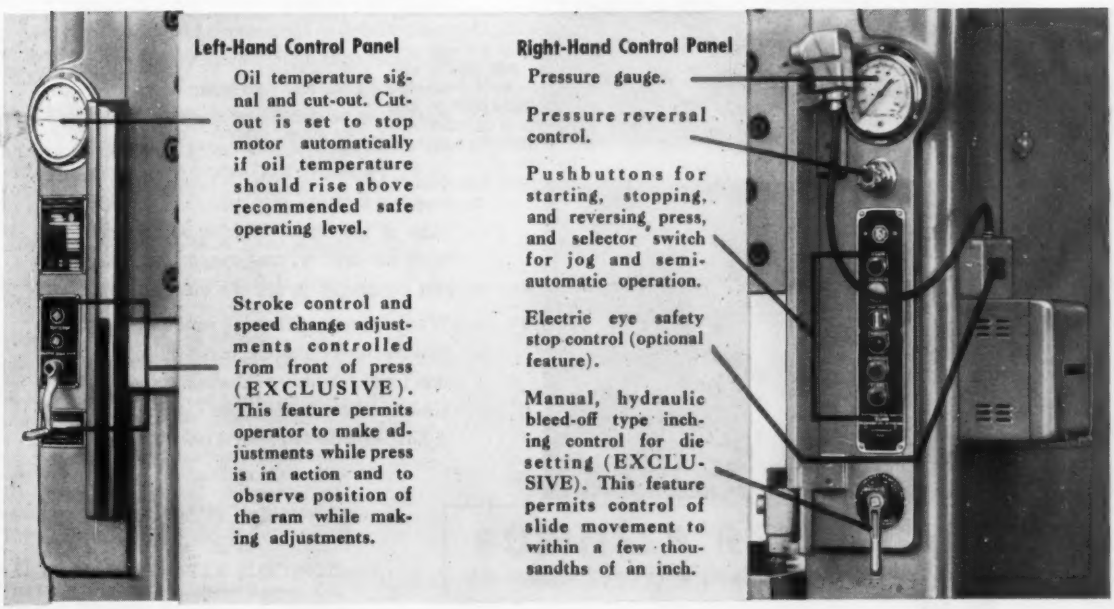

Left-Hand Control Panel

Oil temperature signal and cut-out. Cut-out is set to stop motor automatically if oil temperature should rise above recommended safe operating level.

Stroke control and speed change adjustments controlled from front of press (EXCLUSIVE). This feature permits operator to make adjustments while press is in action and to observe position of the ram while making adjustments.

Right-Hand Control Panel

Pressure gauge.

Pressure reversal control.

Pushbuttons for starting, stopping, and reversing press, and selector switch for jog and semi-automatic operation.

Electric eye safety stop control (optional feature).

Manual, hydraulic bleed-off type inching control for die setting (EXCLUSIVE). This feature permits control of slide movement to within a few thousandths of an inch.

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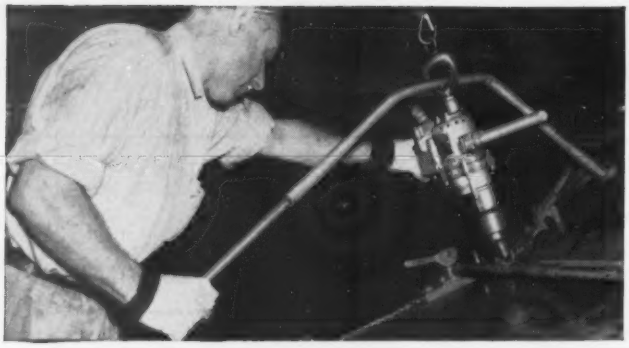

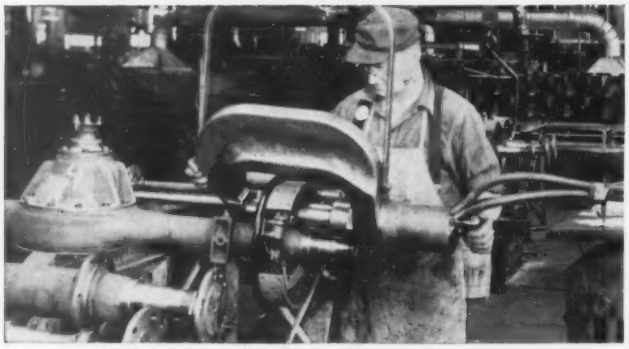

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For more information on products advertised, use Inquiry Card, page 255

PRODUCT INFORMATION SERVICE

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On New Catalogues described in this issue of MACHINERY
On products mentioned in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

CEMENTED-CARBIDE TOOLS AND BLANKS—Carboloy Department of General Electric Co., Detroit, Mich. Publication GT-285, a 24-page Brief-A-Log condensed catalogue, giving specifications and latest price changes on all Carboloy standard cemented-carbide tools and blanks. Also listed, for the first time, are specifications and prices on throw-away inserts, new saw tips, solid and brazed type woodworking knife blanks, and right- and left-hand offset threading tools and blanks for roller turner tools. 1

CENTERLESS GRINDING MACHINE—Cincinnati Grinders, Inc., Cincinnati, Ohio. Publication G-644, describing and illustrating the new Cincinnati Filmatic No. 2 centerless grinding machine. Construction details are given, together with dimensional drawings. Standard equipment supplied with the machine is listed, as well as concise descriptions of the equipment that can be supplied to further increase the range of application. 2

BRAKES—O'Neil-Irwin Mfg. Co., Lake City, Minn. 16-page manual entitled "Handy Guide to Aid You in Selecting and Operating Di-Acro Brakes." By means of thirty-five photographs and diagrams, ten models of Di-Acro standard, box finger, and radius brakes are shown set up in various ways for production or experimental forming jobs. Capacity of all Di-Acro brakes is 16-gage mild sheet steel. 3

FINISHING OF DIE-CASTINGS—American Wheelabrator & Equipment Corporation, Mishawaka, Ind. Bulletin 101-D, showing the application of airless abrasive blasting, as done on the company's Wheelabrator machines, to the deflashing, deburring, and surface preparation work required for die-castings. Case histories from four typical companies are presented to show savings that may be obtained. 4

MAINTAINING COMPLEX ELECTRICAL CONTROLS—W. F. & John Barnes Co., Electrical Division, Rockford, Ill. Booklet describing a recent development by Barnes engineers for simplifying the maintenance of complex electrical controls and reducing costly "down" time. A detailed description is given of the general design principles and operation of the Electro-Graphic Detector. A typical test procedure for locating electrical control failures is presented. 5

HYDRAULIC CYLINDERS—Vickers, Inc., Detroit, Mich. Bulletin 54-68, describing the company's new "Compact" hydraulic cylinders for general industrial application. Cut-away photographs illustrate design features, and installation drawings are given for each of the five cylinder mounting styles available. A chart is provided for determining piston areas, piston speeds, and output forces for cylinders for both standard and heavy-duty piston-rods. 6

GEAR HOB TOLERANCES—Star Cutter Co., Farmington, Mich. Manual SC-1, listing tolerance standards for both single and multiple thread gear hobs from 2 through 51 diametral pitch and finer. Tolerances are given for precision ground, commercial ground, accurate unground form, and commercial unground form classes of hobs. The company's line of special milling cutters is illustrated. . 7

CLUTCHES—Formsprag Co., Van Dyke, Mich. Catalogue 102, 20 pages descriptive of Formsprag full-complement clutches—over-running, indexing, and backstopping—and clutch-coupling units. Engineering and specification data concisely describe each clutch of the six standard lines, supplemented by photographs and application drawings. Helpful information is given on the installation and maintenance of these clutches. . . 8

STAINLESS STEEL—Carpenter Steel Co., Alloy Tube Division, Union, N. J. 20-page catalogue giving the latest information on Carpenter stainless No. 20 and No. 20-Cb—sulphuric acid resisting steels. Field reports describe performance of the steel under varying corrosive conditions. Physical and mechanical properties, together with a list of the various forms and shapes available, are given. 9

NICKEL ALLOYED CAST IRONS—International Nickel Co., Inc., New York City. Bulletin A-69 entitled "Guide to the Selection of Engineering Irons," containing 28 pages of basic information on the modern nickel cast irons, and describing their improved physical and mechanical properties which can be produced by any foundry having reasonable control. The bulletin has been compiled primarily for design engineers 10

TOOLS, BACK-RESTS, AND HOLDERS—R and L Tools, Philadelphia, Pa. 32-page catalogue listing the entire R and L line: turning tools; carbide or roller back-rests; releasing or non-releasing tap- and die-holders; universal toolposts; cut-off blade-holders; recessing tools; revolving stock stops; floating drill-holders; and knurling tools. Information is included on the proper use of these tools. 11

UNIDIRECTIONAL MOTORS—Barber-Colman Co., Small Motors Division, Rockford, Ill. Bulletin F 3959-2, describing features and performance characteristics of Barcol Type YAR heavy-duty unidirectional motors, used to drive pumps, fans

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and blowers, record changers, and industrial controls. Ratings are available up to 1/20 H.P. at 3000 R.P.M. Typical performance curves are given. 12

SURFACE GRINDER ATTACHMENT—Cylindex, Inc., Binghamton, N. Y. Folder descriptive of the Cylindex, an attachment which fits all makes of surface grinders. The attachment will grind tapers and flat surfaces to high accuracy, and because it can be placed on the magnetic chuck, turned to any angle, it can be used to grind milling cutters and other intricate tools. 13

MILLING MACHINES—Cincinnati Milling Machine Co., Cincinnati, Ohio. Publication M-1870, on the Cincinnati Toolmaster milling machine. Design highlights, exclusive features, functional diagrams, and specifications are covered. The Toolmaster is built in three styles—with manual feed to quill; with power feed to quill; and with heavy-duty spindle head. 14

MECHANICAL TUBING—Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa. Bulletin TB-365, outlining the advantages offered to design and fabrication engineers who consider tubing in the manufacture of cylindrical hollow parts. A selection guide on B&W stainless mechanical tubing gives properties and processing data. 15

ARMORED MOTORS—General Electric Co., Schenectady, N. Y. Bulletin GEA-4654C, containing 19 pages of information on the performance and maintenance features of G-E armored motors in direct-current-types. Diagrams and photographs illustrate various applications of these motors in the steel, lumber, oil, and construction industries. 16

TOOL BITS—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Bulletin containing technical information on ALX alloy tool bits, which are made of nonferrous alloy containing boron, for use in the cutting range between high-speed steel and carbides. The bulletin includes new information on applications, grinding, tool angles, speed and feeds, brazing, and stock sizes. 17

ULTRASONIC FLUXLESS SOLDERING—Aeroprojects, Inc., West Chester, Pa. 10-page booklet covering applications of Sonobond ultrasonic fluxless soldering of aluminum, copper, brass, silver, and magnesium. The equipment used at the company's pilot plant for handling ultrasonic soldering of parts for other companies is described. 18

DRILL ROD—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Leaflet featuring information on Allegheny Ludlum high-speed carbon and alloy steel drill rod. Data on grades, lengths, size ranges, finishes, and tolerances are included. Standard cold-drawn drill rod shapes and special shapes that are available are described. 19

FLUID COUPLINGS—Twin Disc Clutch Co., Racine, Wis. Bulletin 144-D, giving installation and performance data on Twin Disc fluid couplings. Diagrams show how these fluid couplings can easily be applied on any type industrial equipment, powered by electric motor or internal combustion engine from 3/4 to 850 H.P. On-the-job applications in various industries are shown. 20

SQUARING SHEARS—Columbia Division, Lodge & Shipley Co., Hamilton, Ohio. Brochure containing four folders describing the complete line of squaring shears from 3/16- to 3/4-inch capacity in mild steel; a shear accessories folder; three folders describing Columbia power press brakes; and a folder featuring the new Columbia hydraulic compression molding presses. 21

EPOXY RESIN ADHESIVES—Armstrong Products Co., Warsaw, Ind. 16-page booklet containing technical data and price information on the company's epoxy resin adhesives, formulated for difficult bonding problems involving materials such as metals, wood, glass, ceramics, hard rubber, and thermosetting plastics. 22

PRECISION INSTRUMENT COMPONENTS—Pic Design Corporation, Lynbrook, N. Y. Catalogue 5, consisting of 64 pages illustrating and describing the company's precision shafts, gears, collars, couplings, and other parts available from stock to meet the needs of experimental, development, and manufacturing departments. 23

PRECISION MACHINING FACILITIES—Connecticut Mechanical Industries, Inc., Hartford, Conn. Booklet depicting case histories of intricate special machining projects accomplished by the company, and briefly describing how the individual tooling problems were overcome and minute tolerances met. A list of the company's facilities is provided. 24

HYDRAULIC DUPLICATORS—Lansing Die Sinking Co., Lansing, Mich. Folder descriptive of Goodrich hydraulic duplicators for large or small tool shops and manufacturing plants. Several examples are given, showing the duplicator adapted to a P&W milling machine, a Gilbert boring mill, and a Cincinnati milling machine. 25

DESIGNING WELDED STEEL MACHINE PARTS—Lincoln Electric Co., Cleveland, Ohio. Booklet entitled "Practical Design for Welding," a reprint consisting of three articles on principles for the practical designer to use in designing welded steel machine parts and machinery. Factors that determine costs are considered, and a typical problem is worked out. .26

SMALL MOTORS—Barber-Colman Co., Small Motors Division, Rockford, Ill. Catalogue F4271-5, describing the Barcol line of high-power unidirectional motors available in nine power ratings from 1/200 to 1/40 H.P. These small, rugged motors are used in communication equipment, industrial instruments, and servomechanisms. 27

MACHINING STEELS—Joseph T. Ryerson & Son, Inc., Chicago, Ill. Folder 99-1 entitled "Guide to Selection of Fastest Machining Steels." Relative machinability is given for seventeen different steel analyses, as well as other principal characteristics. Comparisons include carbon, alloy, stainless, and leaded carbon steels. 28

NICKEL ALLOY WALL CHART—Alloy Metal Wire Division, H. K. Porter Co., Inc., Prospect Park, Pa. Wall chart showing engineering properties of nickel alloy

Product Information Service

Use postage-free Business Reply Card below for further information concerning New Catalogues described in this issue and products mentioned in the editorial pages or advertisements.

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171	172												

For more details on products mentioned in January editorial or advertising pages, fill in below:

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wire, rod, and strip. Materials whose properties are described include nickel, Monel, Inconel, Incoloy, and nickel-clad copper. **29**

METAL POWDER PARTS—Amplex Division, Chrysler Corporation, Detroit, Mich. Folder STM-54, giving complete data on a new sintered material called "Steel Oilite" having a high degree of ductility. Some finished machine parts are shown. **30**

POROUS METALS—Micro Metallic Corporation, Glen Cove, N. Y. 45-page booklet giving data on the properties of porous metals produced by the concern. The design and engineering services offered by the company are outlined. **31**

FLEXIBLE SHAFTS—Franklin Balmar Corporation, N. A. Strand Division, Baltimore, Md. Catalogue C-210, presenting tabular data on the three basic types of Strand flexible shaft machines: single-speed direct-drive; multiple-speed countershaft drive; and multiple-speed gear-drive. **32**

METAL-CUTTING TOOLS—Viking Tool Co., Shelton, Conn. 44-page catalogue describing and illustrating the company's complete line of standard cutters with either high-speed steel or carbide blades. The information is intended to help in the selection of the proper cutters for your work. **33**

SLITTING AND CUTTING OPERATIONS—Ohio Knife Co., Cincinnati, Ohio. 28-page manual entitled "Slitting—A Basic Guide for the New Operator," giving helpful hints on slitting and cutting operations, with numerous diagrams and photographs to illustrate major points in the text. **34**

GUIDE-PIN BUSHINGS AND GUIDE PINS—Lamina Dies & Tools, Inc., Royal Oak, Mich. 12-page catalogue giving dimensions and prices of the company's guide-pin bushings and guide pins, which are illustrated by photographs and line drawings. **35**

SPLIT BALL BEARINGS—Split Ballbearing Corporation, Lebanon, N. H. Catalogue 54, containing 24 pages of descriptive information on the company's complete line of split ball bearings. Load and speed ratings, design data, and dimensions are given. **36**

SCREW MACHINE FACILITIES—Biddle Screw Products Co., Sheridan, Ind. Booklet illustrating the facilities of this plant which produces screw machine products. Factual information is presented of interest to production, design, and purchasing departments. **37**

WAX CUTTING FLUIDS—S. C. Johnson & Son, Inc., Racine, Wis. Booklet entitled "Cutting and Grinding with Johnson's Wax Cutting Fluids," describing the advantages of wax in metal-working, as well as giving cutting fluid selection charts. **38**

MACHINING WITH ALUMINUM—Kaiser Aluminum & Chemical Sales, Inc., Oakland, Calif. Folder entitled "New Angle on Greater Profits," citing advantages of aluminum for screw machine stock, with an actual aluminum part attached to the folder. **39**

CENTER HOLE CHART—Ready Tool Co., Bridgeport, Conn. Chart for determining center hole sizes, conforming to the new numbering system for center drills. Sizes are given for shaft diameters from 1/4 inch to 16 inches. **40**

ROTARY AIR MOTORS—Gast Mfg. Corporation, Benton Harbor, Mich. Bulletin 1054-38 entitled "Original Equipment Application Ideas for Product Designers," showing how thirty-five problems were solved with Gast rotary air motors, air compressors, and vacuum pumps. **41**

BENDING BLOCKS—Acorn Iron & Supply Co., Philadelphia, Pa. Folder descriptive of Acorn bending blocks or welding platens. Each block has 289 holes; the blocks can be easily joined together to make a table in 5-foot multiples. . . . **42**

QUENCHING OIL—Sun Oil Co., Philadelphia, Pa. Bulletin 29, descriptive of Sun Quenching oil No. 11, which has a high thermal stability and boiling range, making it particularly suitable for quenching systems requiring a high flash point. **43**

TOOL-ROOM EQUIPMENT—Moore Special Tool Co., Bridgeport, Conn. 16-page booklet marking the company's thirtieth anniversary and describing several new product developments—a form grinder, a rotary table, and a universal measuring machine. **44**

INVOLUTE GEAR CHECKING MACHINES—Michigan Tool Co., Detroit, Mich. Bulletin MIC-54, listing specifications for the company's fourteen models of sine-line involute gear checkers, machines capable of checking the involute form on helical and spur gears up to 36 inches in diameter. **45**

RELAY STEELS—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Technical data sheet, descriptive of Allegheny relay steels, giving information on applications, magnetic properties as indicated by graphs of hysteresis loops and magnetization curves, and physical properties . **46**

REAMERS—DoAll Co., Des Plaines, Ill. Catalogue 51-814, covering a wide va-

(Continued on next page)

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New York, N. Y.

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riety of precision-ground reamers, including hand, shell, expansion, taper pin, stub, and chucking reamers. A selection of shell reamer arbors is also shown. . .47

THREE-PHASE SPOT AND PROJECTION WELDERS—Sciaky Bros., Inc., Chicago, Ill. Bulletin 318-1, featuring Sciaky air-operated, press type, three-phase spot and projection welders. Standard and optional equipment are listed separately .48

PANTOGRAPH ENGRAVER—Green Instrument Co., Cambridge, Mass. Folder descriptive of the Green Model D-2 heavy-duty pantograph engraver which mills, profiles, and engraves large panels and bulky work-pieces. 49

FLUID POWER CYLINDERS AND VALVES—Modernair Corporation, San Leandro, Calif. Folder describing and illustrating the fluid power cylinders, valves, and packaged devices available from the concern. 50

ALLOY TUBING—Crucible Steel Co. of America, Henry W. Oliver Bldg., Pittsburgh 22, Pa. 48-page booklet entitled "Trentweld Stainless and High Alloy Tubing," describing and illustrating the company's tube manufacturing methods. Practical guide and corrosion table are given to help in selecting correct tubing, which is available for 1/8 to 40 inches outside diameter. 51

RADIAL HEAD, FACE GRINDERS—Besly-Bowen Corporation, Beloit, Wis. Bulletin 700, describing the Besly-Bowen radial head grinder. Data is given on increased production. Machines are available in four sizes from 3 to 100 H.P. Specifications of accessory equipment are included. 52

ZINC DIE-CASTINGS—Page & Hall Mfg. Co., Inc., Boston, Mass. Folder showing the company's facilities for producing intricate, small zinc die-castings in short runs on an economical basis. 53

PROFILOMETER—Micrometrical Mfg. Co., Ann Arbor, Mich. Bulletin describing the Profilometer, a direct-reading portable measuring instrument for surface roughness that is intended for shop use. Typical applications are illustrated. 54

VERTICAL MILLING HEADS—American Machine & Solvents Co., Inc., Yonkers, N. Y. Folder descriptive of Brown vertical milling heads for use on most sizes and makes of horizontal milling machines 55

POWER PUNCH PRESS—Klaas Machine & Mfg. Co., Cleveland, Ohio. Folder descriptive of the Emco bench type power punch press, giving specifications and listing common uses. 56

V-BELT DRIVES—T. B. Wood's Sons Co., Chambersburg, Pa. Manual 197, describing the company's V-belts of various designs, and stock sheaves and pulleys. Selection tables and drive design data are included. 57

ELECTRIC RESISTANCE WELDING—Sciaky Bros., Inc., Chicago, Ill. Booklet No. 1, Vol. 4, containing several case histories of small, single-phase welding applications, using standard, low-cost Sciaky welders. 58

HARDNESS TESTER—Torsion Balance Co., Clifton, N. J. Folder describing the characteristics and use of the new Kentrall hardness tester, for regular and superficial Rockwell hardness testing .59

INDEXING TURNTABLES—Eisler Engineering Co., Inc., Newark, N. J. Catalogue 88-55, descriptive of Eisler indexing turntables and variable-speed controls. The indexing range is from 1 to 400 R.P.M. 60

DRILLS—Chicago-Latrobe, Chicago, Ill. Comparison wall chart, listing over-all, flute, and assembled lengths of Chicago-Latrobe drills with tapered split sleeves, for quick reference. 61

AIR GAGING MEMBER RECONDITIONING SERVICE—Freeland Gauge Co., Detroit, Mich. Folder describing the company's service in reconditioning air gaging members to meet specifications . .62

FLEXIBLE COUPLINGS—Ajax Flexible Coupling Co., Inc., Westfield, N. Y. Bulletin 57, consisting of a selection guide for rubber-bronze bushed flexible couplings. 63

CARBIDE DIES—Champion Tool & Die Co., McKeesport, Pa. Leaflet explaining how die costs can be reduced on hexagon recessed screws by the use of Champion carbide heading dies. 64

SMALL CUTTING TOOLS—Woodruff & Stokes Co., Inc., Hingham, Mass. Leaflet showing fifty small precision cutting tools, with profile drawings of their cutting actions. 65

POLISHING UNITS—F. W. Derbyshire, Inc., Waltham, Mass. Leaflet describing the company's Magnus polishing units, designed especially for small burring and polishing operations. 66

GRINDER DOGS—Ready Tool Co., Bridgeport, Conn. Leaflet giving capacities and prices of the nine sizes of cam-action grinder dogs available in stock. 67

TOOL-HOLDERS—Burg Tool Mfg. Co., Gardena, Calif. Leaflet giving specifications and sizes of Toolflex floating tool-holders. 68

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

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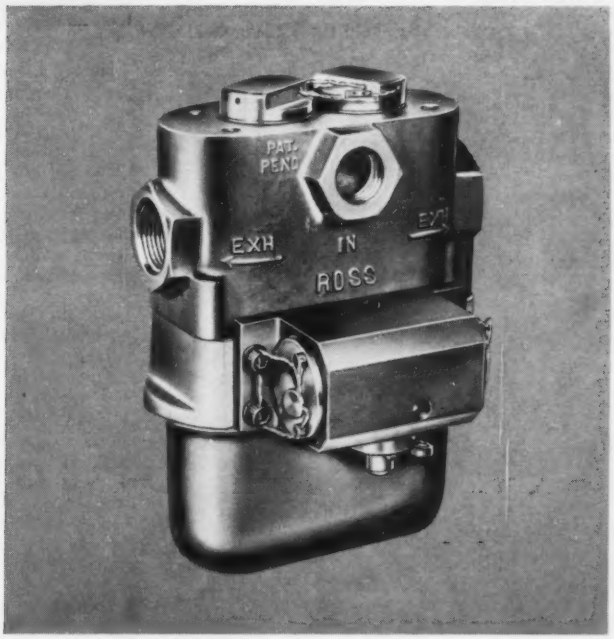
Ross LIFEGUARD



A **NEW** AIR CONTROL SOLENOID VALVE FOR SAFER PRESS OPERATION

Write for Bulletin 306

Tomorrow's Engin*AI*Ring Delivered Today

ROSS Control VALVES

Ross OPERATING CONTROL VALVE COMPANY

120 E. GOLDEN GATE AVENUE • DETROIT 3 • MICHIGAN

been appointed group executive in charge of the new organization. Mr. Erben was formerly group executive in charge of the Apparatus Group, a position which will now be filled by Executive Vice-President ROBERT PAXTON. The Canadian General Electric Co. becomes a part of the Apparatus Group. JOHN W. BELANGER was elected an executive vice-president and appointed to succeed Mr. Paxton as group executive in charge of the Industrial Products and Lamp Group. The X-ray Department now becomes a part of this group. G-E also has announced the change of name of the Defense Products Group to the Atomic Energy and Defense Products Group, and the assignment of group executive responsibility to Vice-President CRAMER W. LAPIERRE, succeeding Mr. Belanger, who, as mentioned, has been transferred to the Industrial Products and Lamp Group. Mr. LaPierre will also continue as general manager of the Aircraft Gas Turbine Division which, together with the Atomic Products Division and the Aeronautic and Ordnance Systems Division, will comprise the group. Executive Vice-President ROY W. JOHNSON retains group responsibilities for the Appliance and Electronics Group.

THE ALUMINUM ASSOCIATION, New York City, has formed a new division comprised of producers of aluminum rolled bar and rod, and wire. R. W. GOSS, Scovill Mfg. Co., Waterbury, Conn., will serve as chairman of the new division.

ROBERT H. BURDSALL was recently elected vice-president and secretary of the Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y. Mr. Burdsall is also manager of market development and advertising.

Robert H. Burdsall, vice-president and secretary of Russell, Burdsall & Ward Bolt and Nut Co.

Also announced was the election of WILLIAM U. CIGLIANO as vice-president. Both men were re-elected to the board of directors.

ERNEST HARTFORD has retired as deputy secretary of the American Society of Mechanical Engineers, New York City, after forty-three years of service to that organization. He will continue to serve the Society in a consulting capacity. One of his major contributions to the engineering profession was his work in reorganizing and reactivating the Council of Engineering Societies Secretaries after World War II.

JACK C. MALUGEN was elected president of the Service Tools Institute, an organization of hand tool manufacturers, at the annual meeting recently held in Chicago. Mr.

Jack C. Malugen, president of J. H. Williams & Co., who has been elected president of the Service Tools Institute

Malugen is president of J. H. Williams & Co., Buffalo, N. Y., manufacturer of industrial and automotive wrenches, tools, and drop-forgings.

ADMIRAL ALAN G. KIRK, chairman of the board of the Mercast Corporation, New York City, has been elected president of the corporation, succeeding S. J. SINDEBAND.

AMERICAN MACHINE & SOLVENTS CO., Yonkers, N. Y., has been appointed exclusive distributor of Brown vertical milling heads in the eastern states.

Ohio

HAROLD J. SIEKMANN has been named vice-president of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. He joined the company in 1911, and has since served as draftsman, salesman, design engineer, and chief engineer. This last post Mr. Siekmann assumed in 1944, the duties of which he will retain in his new position.

Harold J. Siekmann, vice-president of R. K. LeBlond Machine Tool Co.

UNION CARBIDE AND CARBON CORPORATION, New York City, has consolidated its Cleveland offices and stock-room in a modern office building and distributing center at 1300 Lakeside Ave., Cleveland, Ohio. The new headquarters will house all of the divisions of Union Carbide now located in this area: Bakelite Co., Carbide and Carbon Chemicals Co., Electro Metallurgical Co., Haynes Stellite Co., Linde Air Products Co., and National Carbon Co.

FRANK J. LASKEY, manager of purchases and raw materials for the Republic Steel Corporation, Cleveland, Ohio, recently retired, the vacant post being filled by W. T. ADAMS. Also announced were the appointments of J. H. GRAEBING and L. H. RANSOM as assistant managers of purchases.

ARTHUR V. BAUMANN, JR., assistant sales promotion manager of the Lodge & Shipley Co., Cincinnati, Ohio, has been made advertising and sales promotion manager of the Columbia Division of the company, Hamilton, Ohio. Mr. Baumann has been with Lodge & Shipley since 1952.

NORMAN ENGINEERING CO., Chicago, Ill., has been appointed a representative by the HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio, for its Hydraulic Power Division line of products.

WILLIAM J. HIPP was recently appointed a field engineer in the Cleve-

Look into
REVERE EXTRUDED SHAPES
—it may pay you as it did Westinghouse

When engineers of the Westinghouse Electric Corporation, East Pittsburgh, Pa., designed an inner-cooled generator rotor, the problem of making the hollow rotor coils arose. It was decided to make these out of two channel sections, butted together. Such channels could be made by milling solid copper bar, but Westinghouse knew how expensive such a process is. Could Revere produce the channels by the extrusion process? We thought we could, and after close collaboration with Westinghouse engineers, the various design and extrusion requirements were finalized. The channels are extruded, drawn, annealed, and then given a final draw.

Generators containing these special rotors are cooled by forcing hydrogen through the inner-cooled conductors at 30 psig. Because the heat is picked up directly from the copper, cooling performance is greatly increased over former designs. As a result, generator output can be approximately doubled without increasing physical size. To put it in other ways, output is increased per pound of generator weight and per pound of fuel.

Extruded shapes can save a great deal of machining time and money, and make new ideas commercially practical. Come to Revere for them in copper and its alloys and aluminum alloys.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

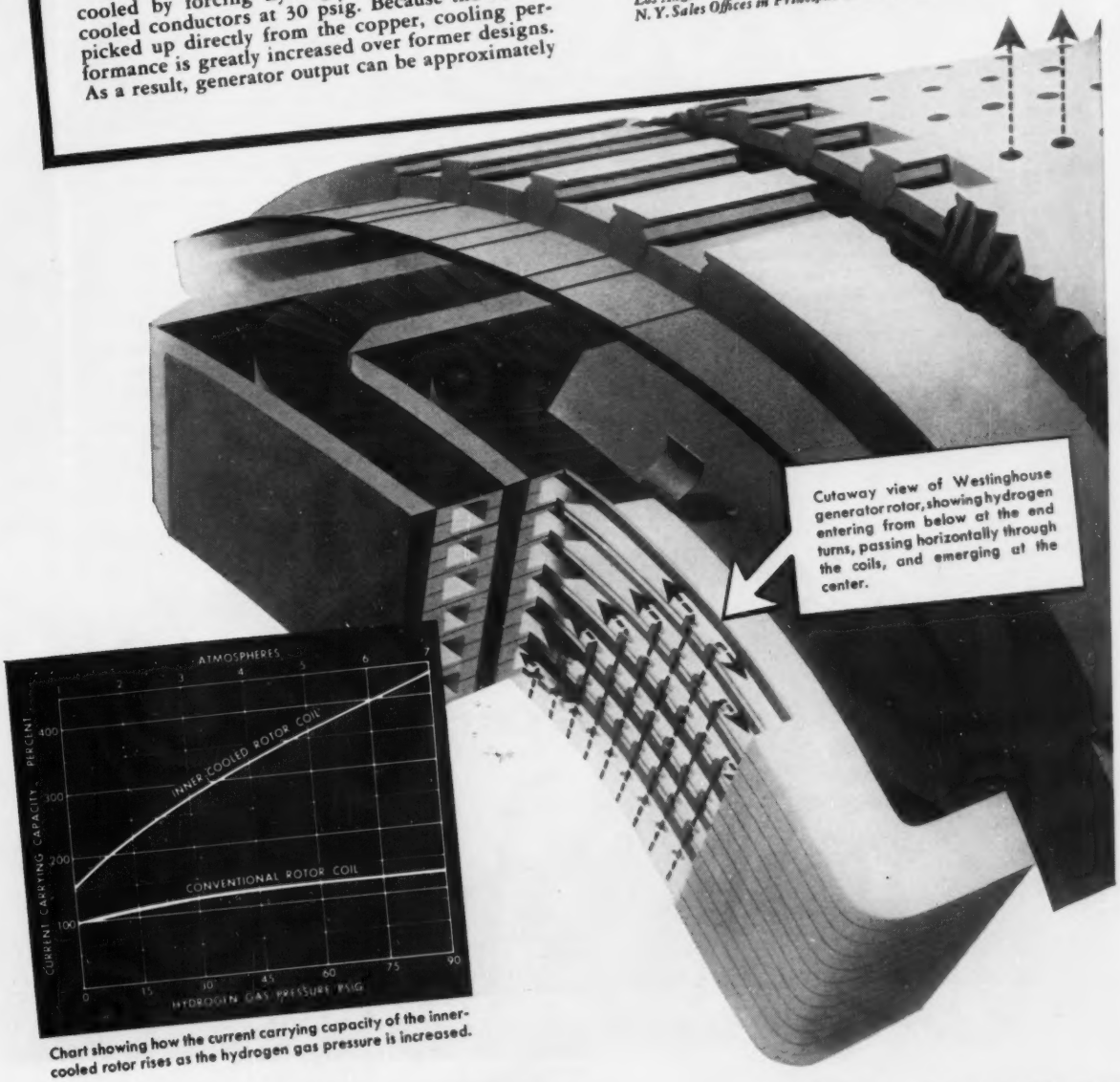


Chart showing how the current carrying capacity of the inner-cooled rotor rises as the hydrogen gas pressure is increased.

Cutaway view of Westinghouse generator rotor, showing hydrogen entering from below at the end turns, passing horizontally through the coils, and emerging at the center.

(Left to Right) Roy Dehn, director of engineering of the Cleveland Crane & Engineering Co.; and Alfred W. Schultz, chief engineer of the Heavy Machinery Division

land, Ohio, area by the Denison Engineering Co., Columbus, Ohio, manufacturer of hydraulic presses and components. Mr. Hipp has been in the hydraulic field for a number of years.

RALPH J. HESS has been named production manager of the Steel Improvement & Forge Co., Cleveland, Ohio. He was formerly superintendent of the E. 64th St. plant, this position now being filled by CARL D. ONDRACEK, who was previously general forge foreman there.

DAVID A. WALLACE was recently elected a director of the Federal Machine & Welder Co., Warren, Ohio. Mr. Wallace retired a year ago from the Chrysler Corporation, where he had been president of the Chrysler Division.

ROY DEHN has been appointed director of engineering of the Cleveland Crane & Engineering Co., Wickliffe, Ohio, a position newly created to integrate the engineering activities of the company. Mr. Dehn, who has been with the company since 1937, was previously chief engineer of the Heavy Machinery Division. He will be succeeded in this post by ALFRED W. SCHULTZ, who will be in charge of overhead traveling crane, press, and shear engineering. Mr. Schultz was formerly chief engineer and sales manager of the Cleveland Punch & Shear Works Co.

Pennsylvania

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., has announced the following promotions: R. S. POISTER, former vice-president of operations, and WALTER H. WIEWEL, former vice-president of sales, have been named senior vice-presidents. Both men, who are directors of the company, will now devote their full capabilities to problems of over-all policy. LORIN L. FERRALL, previously assistant vice-president of operations, has been elected vice-president of operations. JAMES D. GLENN, product manager of stainless steel sales, has been promoted to general manager of sales; and GEORGE W. STAMM, who was assistant to the vice-president of sales, has been named assistant general manager of sales.

IRVING G. MEYER, homecraft products manager for the Delta Power Tool Division of the Rockwell Mfg. Co., Pittsburgh, Pa., has been promoted to assistant to the vice-president in charge of the Division. Mr. Meyer will be responsible for maintaining liaison between the Division's national sales headquarters offices and five regional sales offices. Mr. Meyer joined the Delta Mfg. Co. as a milling machine operator in 1942, several years before Delta became part of Rockwell. Last year, he moved to Pittsburgh as homecraft products manager after eight years in various Delta sales positions in Milwaukee.

FIRTH STERLING, INC., Pittsburgh, Pa., announces the appointment of the following distributors for its tool steel and sintered carbide products: FREY INDUSTRIAL SUPPLY CO., Los Angeles, Calif.; A. J. GLESENER CO., INC., San Francisco, Calif.; CHANDLER & FARQUHAR CO., Boston, Mass.; ELECTRIC TOOL & MACHINERY CO., Baltimore Md.; FARQUHAR MACHINERY CO., INC., Jacksonville, Fla.; BRAMMALL SUPPLY CO., Benton Harbor, Mich.; E. C. BLACKSTONE CO.,

(Left to Right) R. S. Poister and Walter H. Wiewel, senior vice-presidents of the Crucible Steel Company of America; and Lorin L. Ferrall, vice-president of operations

Here's what the **SUNNEN** folks wrote us recently about their Sidney Lathes:

TELEPHONE: STERLING 2100

SUNNEN PRODUCTS COMPANY

Automotive Service Equipment · Precision Honing Machines

7910 MANCHESTER AVENUE, ST. LOUIS 17, MISSOURI

Our 16" Sidney has proved to be everything Sidney said it would be.

We have made many odd shaped dies and it will duplicate as accurately as a master part or template.

The Sidney is also easy to operate, the height is just right and all levers are conveniently located.

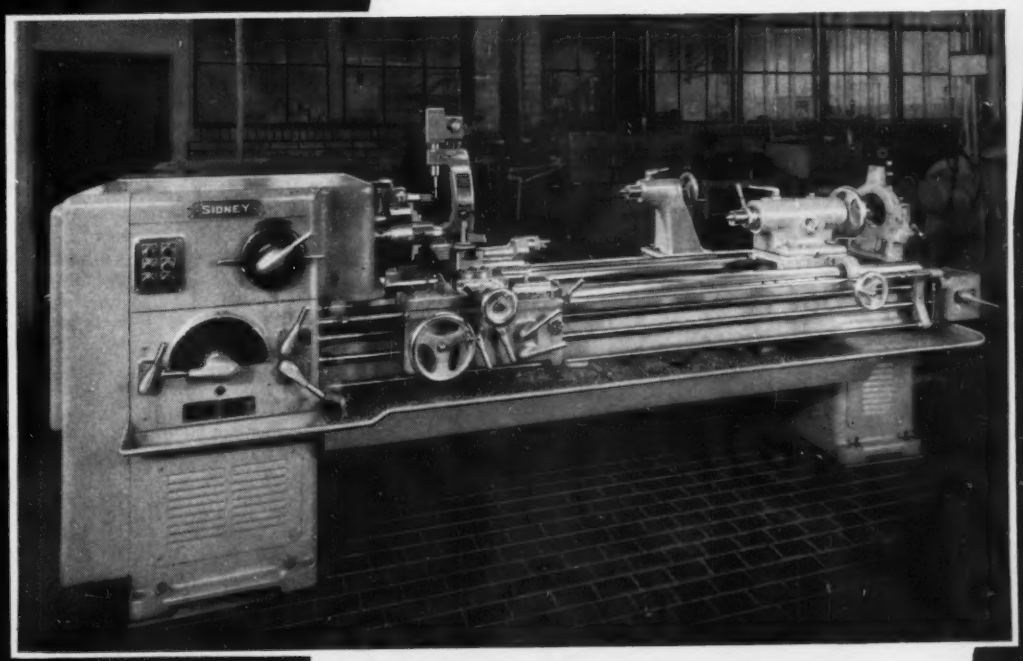
It is a real pleasure to operate a Sidney.

Cordially,

SUNNEN PRODUCTS COMPANY

George Maechling

George Maechling
Tool Room Foreman



SIDNEY FLUID TRACER LATHES

For you . . . as well as for Sunnen Products Company of St. Louis and scores of other leading makers of precision equipment . . . Sidney Lathes can do a terrific job . . . ECONOMICALLY!

The sensitive tracer head transfers every change in contour from any master piece or template to the cutting tool. A separate control switch turns off the tracer motor while the machine is performing standard lathe work.

WRITE FOR BULLETINS

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

Memphis, Tenn.; and LOSEY & Co., Easton, Pa.

CONDE HAMLIN, vice-president in charge of sales and a director of DeWalt, Inc., Lancaster, Pa., subsidiary of the American Machine & Foundry Co., New York City, has been elected executive vice-president. Mr. Hamlin came with the parent company in 1952 as assistant to the director of sales of the General Products Group, and later served as general sales manager of DeWalt. The subsidiary manufactures power cutting tools.

CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., announces the following sales appointments: HOWARD M. GIVENS, JR., manager of tool sales, and WILLIAM G. HASSELL, manager of the Pittsburgh Crucible Division, have been made assistant general managers of sales; and WILLIAM B. DOWNES, who was active in general sales work in the Stainless Steel Division, has been named assistant manager, stainless sales. Mr. Givens will continue to be located at Syracuse, N. Y., in the Sanderson-Halcomb Works, while Mr. Hassell and Mr. Downes will retain their offices in Pittsburgh.

WALL COLMONOY CORPORATION, Detroit, Mich., has opened a stainless steel processing plant in Morrisville, Pa. The plant will be headquarters for the Stainless Processing Division, with JOHN KOZELSKI as general plant manager. Previously, Mr. Kozelski was eastern representative for this Division.

JOHN E. HAIG, vice-president and secretary of the Ajax Electric Co., Philadelphia, Pa., was recently elected president, succeeding the late William Adam, Jr.

Texas and Alabama

SIZE CONTROL CO., Chicago, Ill., announces that its representative in Texas, FRANK SCHEFFLER, has renamed the company bearing his name to the SOUTHWEST INDUSTRIAL SALES CO., Dallas, Tex.

GEORGE M. MERIWETHER has recently been appointed industrial equipment representative for Alabama by the Mattison Machine Works, Rockford, Ill. Mr. Meriwether is president and manager of his company, which consists of six sales and service engineers, located at 1712 Seventh Ave., North Birmingham, Ala.

Canada

J. GORDON BARKER was recently elected president of Vanadium-Alloys Steel Canada, Ltd., London, Ontario. J. P. GILL, president of the American parent company, Vanadium-Alloys Steel Co., Latrobe, Pa., has been made chairman of the board. Mr. Gill previously served as president of the Canadian company.

* * *

Sliding Chart Gives Steel Analyses

A sliding chart has been made available by the Lebanon Steel Foundry, Lebanon, Pa., which gives in handy form the analyses for all Circle L stainless and corrosion-resistant alloys produced by the company. The nominal physical properties of each alloy are also provided, as well as comparable designations of various societies in the metal-working field.

Obituaries

DR. RICHARD H. PATCH, vice-president and a member of the board of directors of E. F. Houghton & Co., Philadelphia, Pa., died recently at Hot Springs, Ark., at the age of sixty-six years. He lived in Jenkintown, Pa. Dr. Patch was a past president of the Philadelphia Chapter of the American Society for Metals. He is survived by his wife and two daughters.

FRED H. JOHNSON, president of the Progressive Welder Sales Co. and the Progressive Welder Co., Detroit, Mich., died suddenly at his home on November 2 at the age of fifty-eight years. Mr. Johnson was widely known throughout industry as the inventor of the automatic, multiple-point welding machine.

V. HARVEY DIETERICH, retired vice-president of Joseph T. Ryerson & Son, Inc., Chicago, Ill., died on December 5 at the age of sixty-nine years. Mr. Dieterich was with the company in its Chicago plant for forty-five years until his retirement in 1950.

CLIFFORD S. ANDERSON, advisory counsel for the Norton Co., Worcester, Mass., died on November 10 at the age of seventy-six years. He started his career with Norton in 1911.

* * *

In the United States there is one passenger car for every four persons. This is equivalent to one automobile for every 1.2 families.

Winners of the 1954 Machine Tool Awards, conferred at annual meeting of the American Society of Mechanical Engineers, held at the Hotel Statler, New York City, were Frank G. East (left), vice-president and general manager, Hamilton Machine & Gear Co., Toronto, Ontario; and George N. Levesque (center), director of research, Brown & Sharpe Mfg. Co., Providence, R. I. Harry R. Westcott (right), chairman of the A.S.M.E. Board on Honors, who conferred the Awards

Proven producer

SURVEY

DESCRIPTION OF WORK:
Surfacing 24" square steel plates

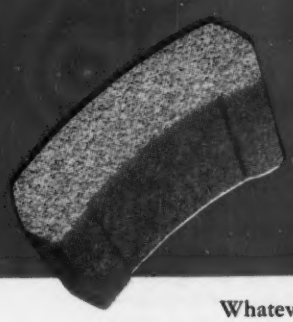
SEGMENTS:
Simonds NA36-J16-V (open structure)

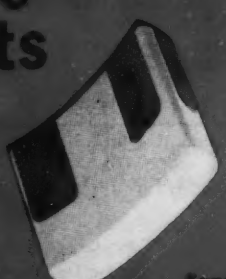
PERFORMANCE:
Gave fast, free-cutting action with long segment life. Eliminated excessive dressing

INCREASED PRODUCTION 15%.

SIMONDS ABRASIVE CO.

abrasive segments





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"Abrasive Segments" form ESA-188

Whatever your grinding job, there's a Simonds Abrasive product to help you do it better. Free consultation with our Engineering Service may reveal "profit leaks" in your present operations.

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Division of Simonds Saw and Steel Co., Fitchburg, Mass. • Other Simonds Companies: Simonds Steel Mills, Lockport, N.Y., Simonds Canada Saw Co., Ltd., Montreal, Quebec and Simonds Canada Abrasive Co., Ltd., Arvida, Quebec

New Books and Publications

PLANT AND PROCESS VENTILATION. By W. C. L. Hemeon. 448 pages, 6 by 9 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York 13, N. Y. Price, $9.

This book differs from other books on ventilation in that the estimating of ventilation quantities required in various industrial circumstances is given major emphasis, while the subject of duct design, a widely understood technique, has been simplified by condensation of design data to free the designer from unnecessary detail. Contents of the book, by chapter headings, are as follows: Objectives and General Considerations; Dynamic Properties of Airborne Contaminants; Dispersion Mechanisms; Pulvation, Entrainment, and Induction; General Principles of Local Exhaust; Local Exhaust and Exterior Hoods; Control Velocities and X-Distance for Exterior Hoods—Booths; Air Flow in Materials-Handling Systems; Exhaust for Hot Processes; Characteristics of Free Air Jets—Blow and Exhaust Systems—Air Curtains; General Ventilation; Design of Duct Systems; Exhaust Systems for Dust; Evaluation and Control of Heat Exposures; Field Observations—Assembly of Design Data; Fans, Injectors, Natural Draft Chimneys, and Roof Ventilators; and Exhaust Air Cleaning—Dust Collection.

TESTING OF STAINLESS STEEL WELDMENTS. Bulletin 18. By Helmut Thielsch. 26 pages, 8 by 11 inches. Published by the American Welding Society, 33 W. 39th St., New York 18, N. Y. Price (paper-bound), $1.

This is a review of published and unpublished information on mechanical tests; procedure-qualification tests; fluorescent, dye-penetrant, radiographic, and ultrasonic inspection; sectioning of welded structures; magnetic inspection; corrosion testing; metallographic tests; ferrite, carbide, and sigma-phase determination; and crack-sensitivity tests.

MECHANICAL FAILURES OF METALS IN SERVICE. Circular 550. By John A. Bennett and G. Willard Quick. 36 pages, 8 by 10 1/4 inches. Published by the National Bureau of Standards, United States Department of Commerce. (Order from Government Printing Office, Washington 25, D. C.) Price (paper-bound), 30 cents.

This circular describes thirty-five cases representing the most frequently observed types of failures of metal parts in service. The characteristics by which the various types of fractures can be recognized are considered, and recommended precautions are given.

Coming Events

JANUARY 24-28—Five-day private seminar on INDUSTRIAL STANDARDIZATION to be held at the Engineering Societies Building, 29 W. 39 St., New York City, by Dr. John Gaillard. Further information may be obtained by writing to Dr. Gaillard, 400 W. 118th St., New York 27, N. Y.

MARCH 28-APRIL 1—Ninth Western Metal Exposition and Congress sponsored by the AMERICAN SOCIETY FOR METALS and nineteen other technical societies to be held at the Pan-Pacific Auditorium and the Ambassador Hotel, respectively, Los Angeles, Calif. A.S.M. secretary, William H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

APRIL 13-15—Tenth annual Meeting and Lubrication Exhibit of the AMERICAN SOCIETY OF LUBRICATION ENGINEERS at the Hotel Sherman, Chicago, Ill. Administrative secretary, William P. Youngclaus, Jr., 84 E. Randolph St., Chicago 1, Ill.

MAY 16-20—SIXTH NATIONAL MATERIALS HANDLING EXPOSITION at International Amphitheatre, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY 31-JUNE 3—THIRD BASIC MATERIALS EXPOSITION to be held at Convention Hall, Philadelphia, Pa. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

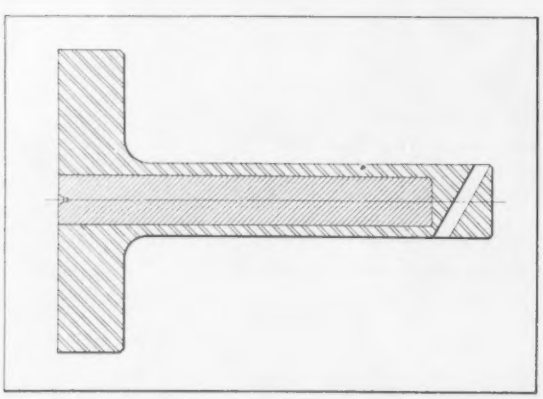
SEPTEMBER 6-17—Machine Tool Show sponsored by the NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION to be held at the International Amphitheatre, Chicago, Ill. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

SEPTEMBER 6-17—PRODUCTION ENGINEERING SHOW, coinciding with the Machine Tool Show, to be held at the Navy Pier, Chicago, Ill. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

* * *

Photographic Slides Show Valve Operation

A series of photographic slides in black and white have been made available by the Denison Engineering Co., Columbus, Ohio, to illustrate the operation of the Series M relief valve. These valves operate at pressures up to 2000 pounds per square inch. There are six slides in the series.



Tungsten carbide, which is known throughout the metal-working industry for its wear resistance and its tooling applications, is finding many new and interesting uses. One such case is the application of tungsten carbide as solid cores for boring-bars to eliminate chatter during machining—a problem common to machine shop operators today. The core of this quill is solid Kennametal Grade K-6, which has a modulus of elasticity of 94,300,000 pounds per square inch

Simonds Canada Saw Co., Ltd., Montreal, Quebec and Simonds Canada Abrasive Co., Ltd., Arvida, Quebec

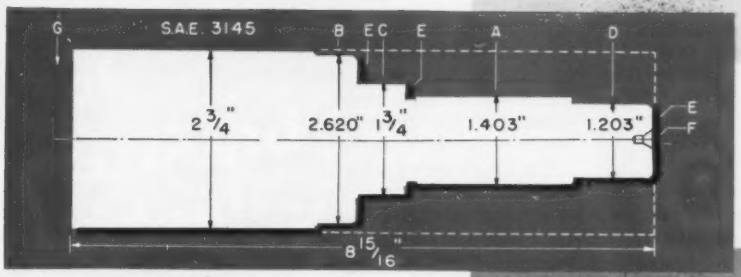
This is the difference High Velocity Turning makes

IN 1950 this job took...

12.40 min.

FLOOR TO FLOOR

A. Turn 489 RPM — .011 feed
B. Turn 340 RPM — .022 feed
C. Turn 489 RPM — .011 feed
D. Turn 489 RPM — .011 feed
E. Face end, shoulders & neck 489 RPM — .0055 feed
Chamfer
F. Center drill
G. Cut off 82 RPM — .0035 feed H.S.S.



IN 1954 this same job takes...

5.40 min.

FLOOR TO FLOOR

A. Turn 694 RPM — .022 feed
B. Turn 694 RPM — .022 feed
C. Turn 694 RPM — .022 feed
D. Turn 694 RPM — .022 feed
E. Face end, shoulders and neck — 694 RPM — .055 feed
Chamfer
F. Center drill
G. Cut off 489 RPM — .0025 feed

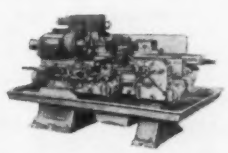
J & L TURRET LATHES GIVE...

MORE Ease of Operation
MORE Power Transmission
MORE Rigidity
MORE Accurate Stops
MORE Efficient Lubrication
MORE Coolant on Cutting Tools
MORE Accurate Results

Visitors who attend J &L's periodic "Production Studies" Seminars see this job turned out in just 5.40 min. on a Jones & Lamson #7A Universal Turret Lathe.

Only with lathes like this, built with plenty of power and the beef to back it up, can your shop take full advantage of the quality, productivity and lower costs offered by High Velocity Turning.

This job is one of the many turned at high speeds on our production line. Come to Springfield and see for yourself. At any rate, send for catalogs #101-A and #102.



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For more information on products advertised, use Inquiry Card, page 255

Tough Tool Steels Required for Cold Extrusion

Cold extrusion is being used successfully in a large Midwestern manufacturing plant for the production of rocket projectile noses from S A E 1010 steel. With this method, the manufacturer was able to lower fabricating costs as well as increase production. A significant share of this success was due to the tool and die steels used in the job.

Finding tool or die steels that could withstand the tremendous strain of the impact was a stubborn problem in getting the job under way. In the first operation, a pressure of 1700 tons is exerted on a 2500-ton press. For the punch, many steels were tried. The highest production from any of them was about 3000 pieces. The difficulty lay in the inability of the steel to stand up under this type of service without prematurely upsetting and cracking. Finally chosen for the job was Carpenter Star-Zenith, an 18-4-1 high-speed steel produced by the Carpenter Steel Co., Reading, Pa. At the last report, the Star-Zenith punch had produced more than 14,000 pieces and was still in operation.

Heat-treatment of the punch consists of hardening in a salt bath at a temperature of 2350 degrees F. and then double-drawing at 1050 degrees F. to a hardness of 62 to 64 Rockwell C. After drawing, the punch is given a liquid nitride treatment for five hours at 1000 degrees F. This treatment develops a surface hardness of approximately 72 to 74 Rockwell C to a depth of about 0.001 inch.

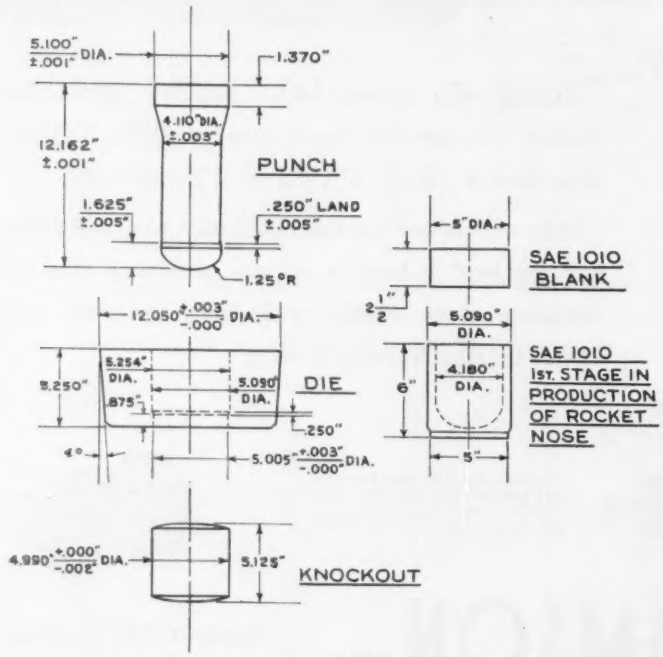
The temperature developed in the punch during the extruding operation is about 500 degrees F., and this temperature is maintained constantly. When the press is idle between shifts, the temperature is held at 500 degrees F. with a special heating jacket. The knock-out is also made of high-speed steel and treated to the same hardness as the punch.

Thorough investigation was also necessary in solving the problem of getting good life from the ring die. Again, different tool steels were tried with little success, the best performance from any of these averaging about 100 pieces. After extensive testing, the plant decided to use Carpenter Vega, a non-deforming, air-hardening, manganese - chromium - molybdenum die steel. When last reported, the Vega ring had turned out 23,000 cups.

This ring is given the standard heat-treatment and put into operation at a hardness of 58 to 60 Rockwell C. Hardening of this ring is simple since there is no need for high-temperature furnaces or packing. Also, the scale flakes off the tools in air cooling. Another advantage of the steel in this application is its uniform hardness from surface to center in large sections.

In the case of steels previously applied, failure of the ring occurred when the strain exceeded the elastic limit of the steel. Even though the ring die is press-fitted into a 4-foot diameter hardened retainer ring having a hardness of 34 to 36 Rockwell C, the force exerted in the extruding operation stretches the die so that the inside diameter becomes too large for the close tolerance requirements of the cup. This must be held to 0.010 inch of specified wall thickness.

The hardness of the S A E 1010 steel increases from about 60 to 90 Rockwell B during the cold forming of the 14-pound 6-ounce slug. The resulting increase in mechanical properties in this and all subsequent operations meets specifications exactly and eliminates the need for a final heat-treatment of the finished nose.



Rocket projectile noses are cold-extruded from S A E 1010 steel blank shown at right. Dimensions of tools employed for first stage in extruding are given at left.

* * *

Flame-Plating Aluminum Gives the Wear Resistance of Tungsten Carbide

How to make a lightweight drive arm with high wear resistance posed a difficult design problem to the Herman Nelson Division of the American Filter Co., Moline, Ill., manufacturer of aircraft heater mechanisms. Plastic inserts, high-alloy precision castings, and machined high-alloy forgings were considered, but cost or weight made them impractical. The problem was solved by using a forged-aluminum part which had been plated with tungsten carbide by applying the Linde flame-plating process. Light weight, low inertia, and high resistance to wear were advantages obtained. An unplated drive arm had an expected service life of from 100 to 300 hours. After flame-plating, the part exceeded the required 1000-hour mark.

* * *

Approximately 136,000,000 motor vehicles have been produced in fifty-four years in the United States.

Look at all the NEW STOCK SIZES of Flat Ground Die Steel

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OIL HARDENING TYPE — Non-deforming, spheroidize-annealed for best machinability and consistently uniform hardenability — from Simonds' own steel mill. Extra-smooth finish with all decarburization and surface defects removed. Wide hardening range. Individually packaged (18" and 36" lengths) with simplified heat treating instructions.

AIR HARDENING TYPE — Non-deforming, spheroidize-annealed, 5% chrome — more wear-resistant yet easy to machine and heat treat with uniformly excellent results — another product of Simonds steel mill. Decarburization and surface defects removed. Wide hardening range. Individually packaged with heat treating instructions.

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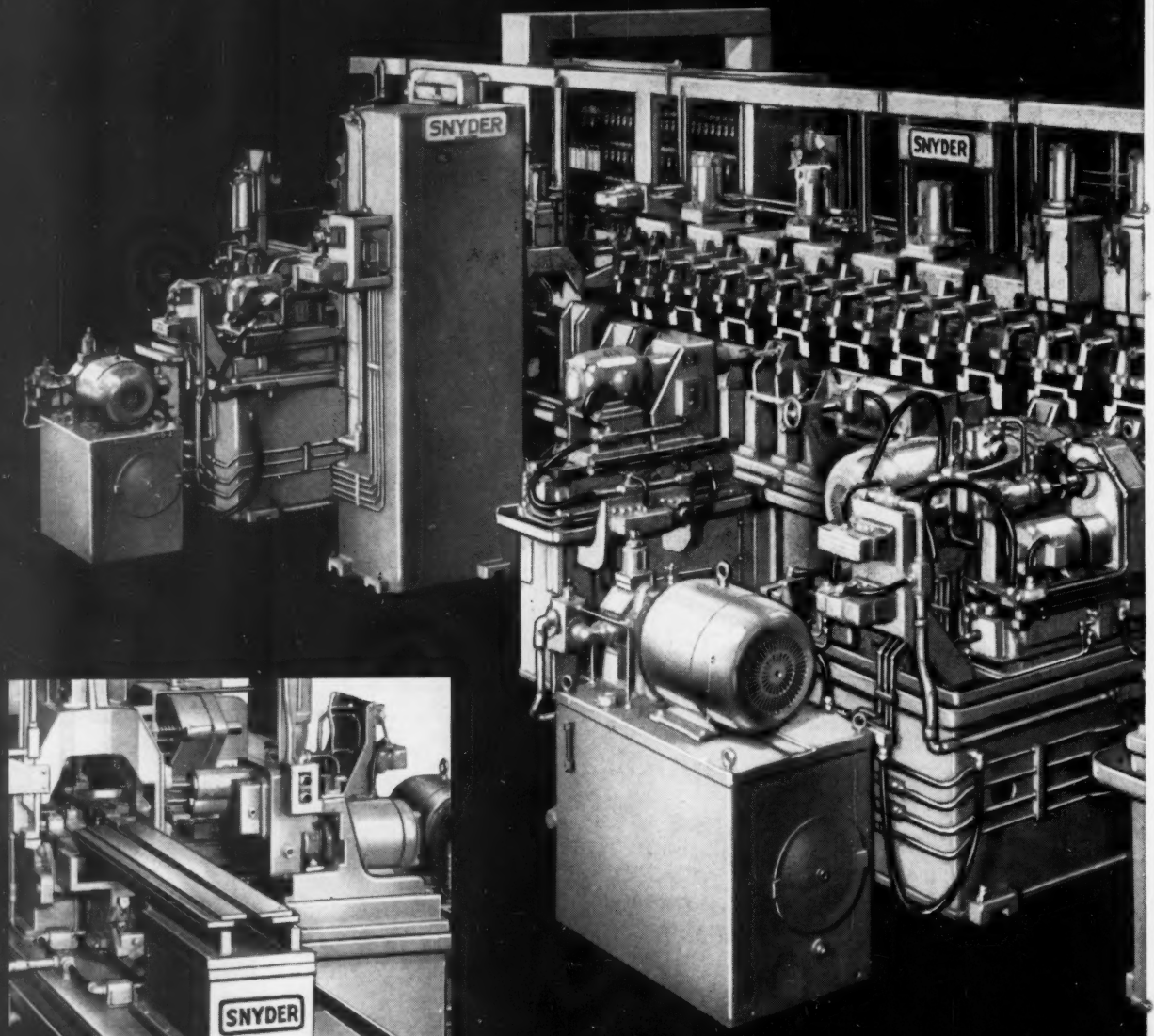

This is the discharge end of the machine. The part, which is originally in vertical position, is laid horizontally and swung 90° to expose all sides to the tools.

SNYDER SPECIAL automatic

24-station transfer machine for processing automotive water pump housings; drills, mills, faces, chamfers, taps all holes and probes tap drill holes. Production, 81 pieces an hour at 80% efficiency.

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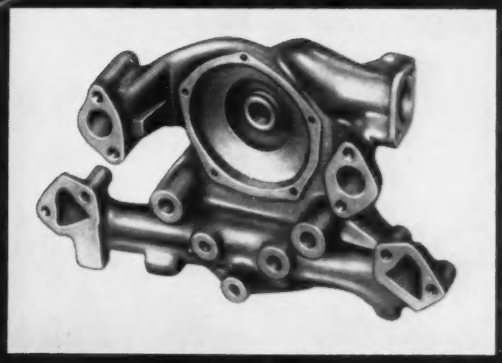

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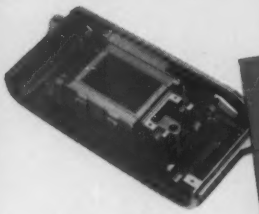
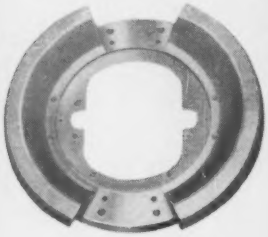
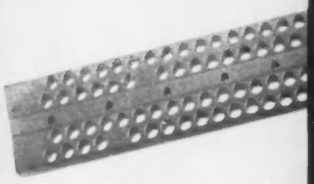


In Plastics

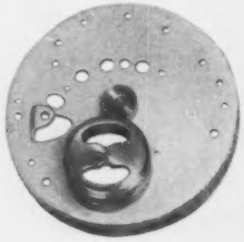
In Aluminum



In Cast Iron



In Wood



In Steel

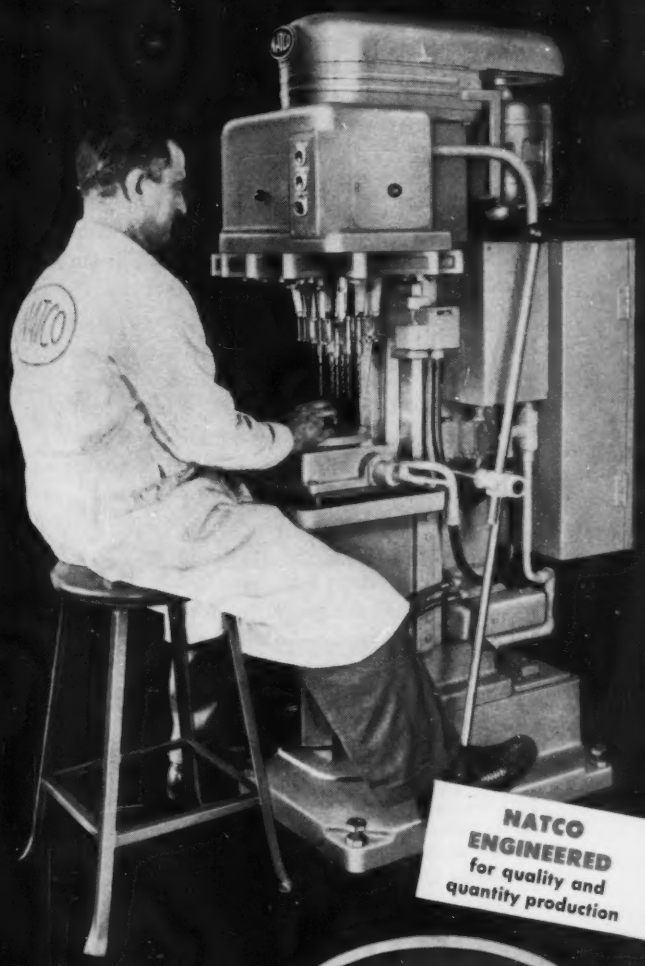
NATCO
HIGH SPEED, SENSITIVE
MULTI-DRILLERS and TAPPERS

H-5 and H-6
STANDARD AND HEAVY DUTY
MACHINES
(H-6 Machine Illustrated)

...REDUCE COSTS WITH INCREASED PRODUCTION OF SMALL PARTS!

The NATCO Model B-33 light, sensitive multi-drilling and tapping machine shown at right is available in three feed arrangements: hand and foot feed or combination hand and foot and air-oil feed; and air feed. These machines have adjustable spindle arrangement for different work set-ups and a large working table. They offer maximum production on light work where super-sensitive operations and high speed are important.

NATCO H-5 and H-6 high speed sensitive multi-drillers and tappers are furnished in standard and heavy-duty models with adjustable multi-spindle, fixed center spindle or slip spindle type heads. They are provided with change gears and quick change speed mechanism for correct spindle speeds. They will efficiently handle a wide range of small and medium-sized work and make possible multiple drilling or tapping of small holes at minimum cost.



B-33
LIGHT, SENSITIVE
MACHINE

NATCO ENGINEERED for quality and quantity production

Call a Natco Field Engineer

to help you solve your problems in Drilling, Boring, Facing and Tapping

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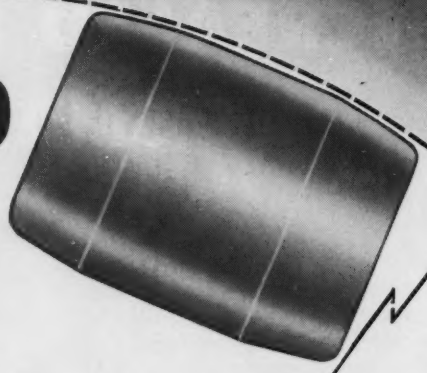
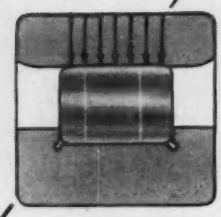
NOW... all Tru-Rol Bearings have CROWNED ROLLERS



● When a straight cylindrical roller bearing is under load, the highest stresses tend to concentrate at the roller ends. Stresses may become excessive and cause early bearing failure.

Crowning is a Rollway grinding refinement that adds a long radius curve to the roller ends. This relieves the high stress areas — allows the rollers to take heavier loads and reduces the effect of slight shaft misalignment or deflection. Bearings can be load rated at substantially higher values — provide a longer service life.

Crowning is but one of the many engineering advances built into Rollway Tru-Rol Bearings. Write for the complete story. Rollway Bearing Co., Inc., Syracuse, N.Y.



Crowned roller under full load — stress uniformly distributed.

Crowned Tru-Rol Bearings available in the following type:

Full Roller

Segmented Steel Retainer

Carefully selected crown radius, varying from 20" to 260", provides proper relief for normal loading to which bearing will be subjected.

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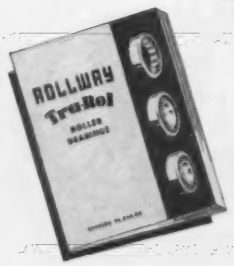
Stamped Steel Retainer with Guide Lips



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"We are very pleased with our H-P-M. For years we felt we could do as well as anyone on depth and severity of draw but H-P-M has certainly broadened our scope in this respect—and at lower costs."

Mr. Ralph F. Mueller
Exec. Vice President
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General Metal Products Reports Broadened Scope and Lower Costs with 700-ton H P M Hydraulic.

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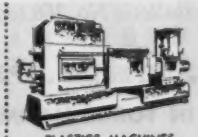
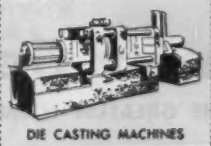
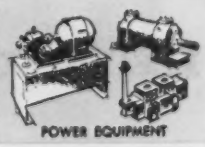

PLASTICS MACHINES


DIE CASTING MACHINES

C—PRESSES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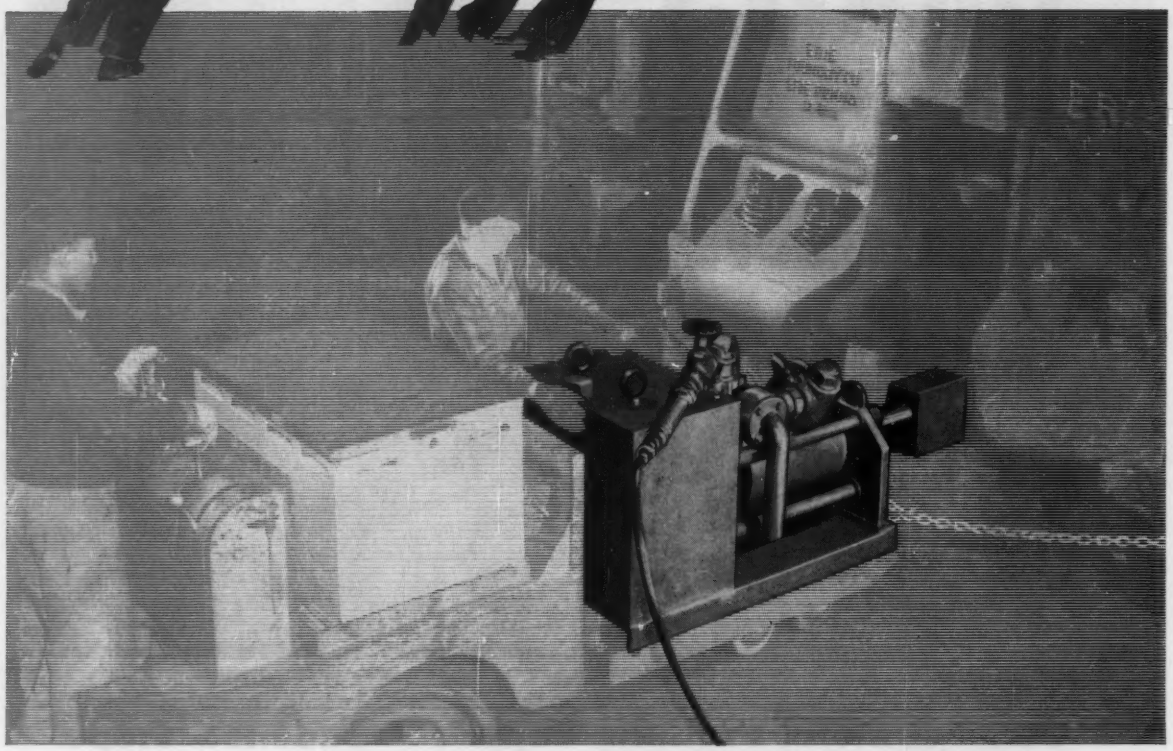

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Now, when driving die and sow block keys in forge hammers, the new Erie Key Driver will do with *two* men in *15* minutes what used to take *5* men (don't forget the crane operator) several hours! Let Erie Foundry Co. show you how to save maintenance man-hours, eliminate wasteful down time, reduce accidents.

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There's no danger of ram end-swing, no glancing blows, minimum mushrooming of keys. Every Erie Key Driver blow is true. One user says,* "The incidence of personal injury and property damage has been reduced to a relatively negligible nature by using the very efficient Erie Key Driver."

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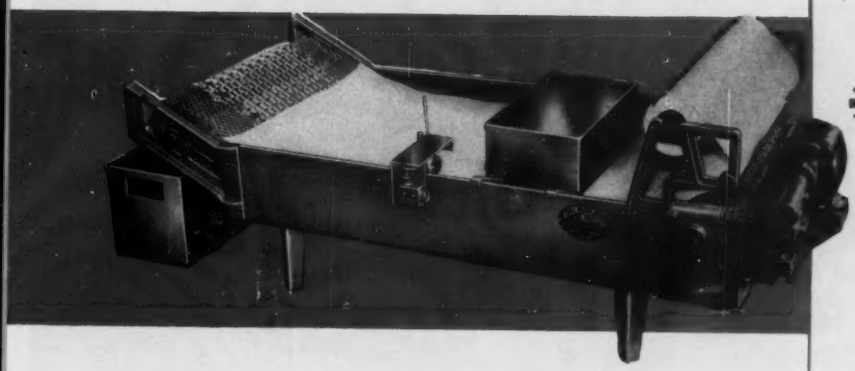

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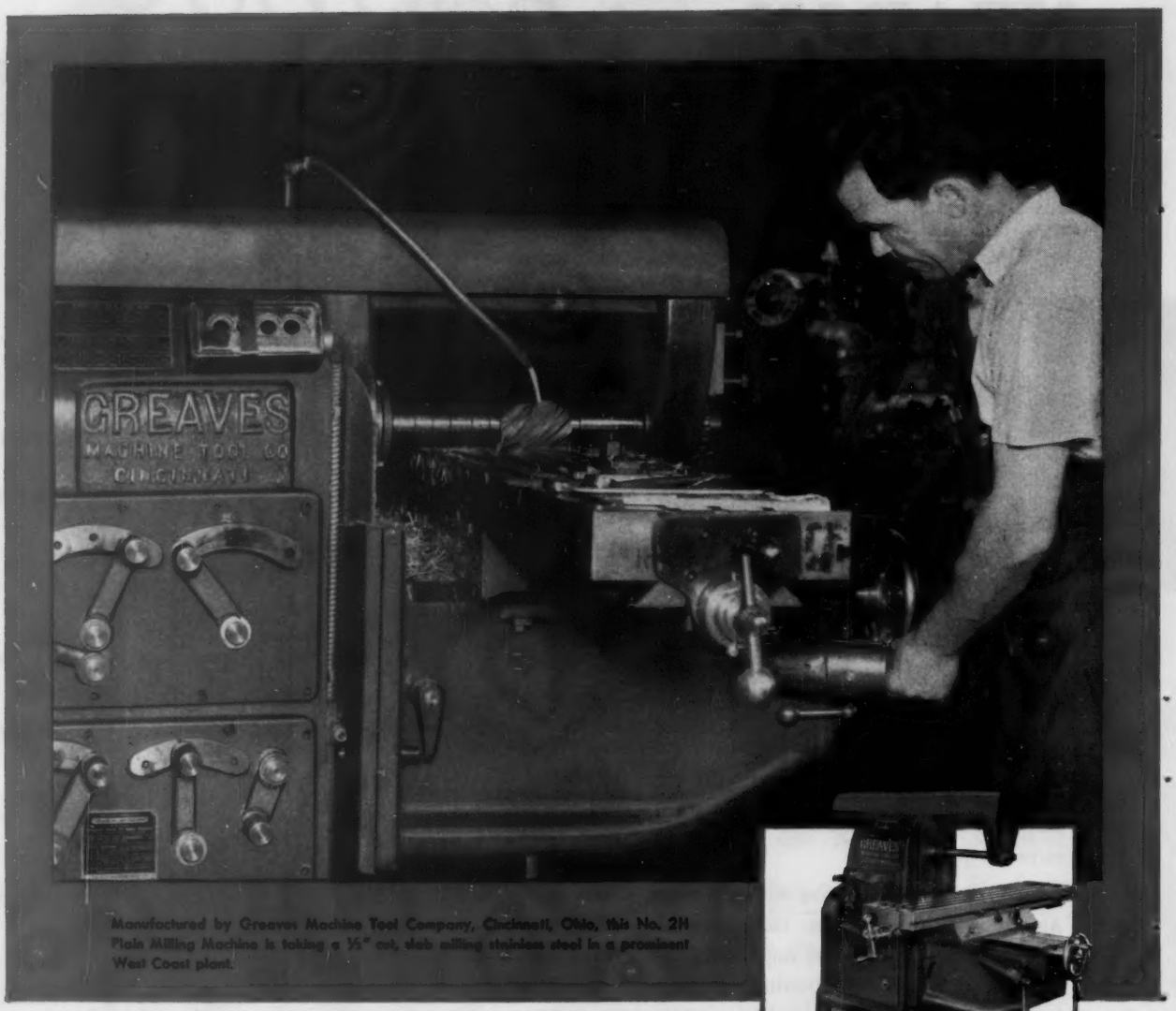
Delpark INDUSTRIAL FILTRATION

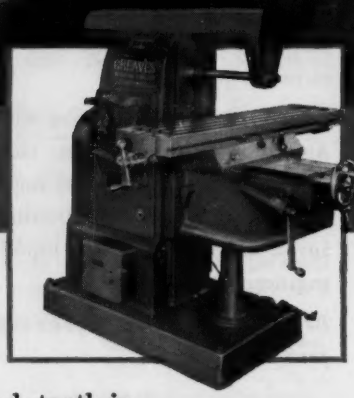
INDUSTRIAL FILTRATION COMPANY, 15 INDUSTRIAL AVENUE, LEBANON, INDIANA

Takes ½ inch cut in stainless

SCULLY JONES **Precision**



Manufactured by Greaves Machine Tool Company, Cincinnati, Ohio, this No. 2H Plain Milling Machine is taking a ½" cut, slab milling stainless steel in a prominent West Coast plant.



Greaves No. 2H Plain Milling Machines "factory-equipped" with Scully-Jones Precision Arbors

On heavy slab milling cuts, it's important that each tooth in the cutter take its share of the load. That's why Greaves engineers specify Scully-Jones Style "B" *precision built* Arbors . . . the arbors that prolong tool life by eliminating runout, wobble, and chatter for efficient milling at maximum feeds and speeds.

steel . . .

Milling Arbor prolongs tool life!

STYLE "B" ARBORS provide rigid setups, permit close-coupling of dual overarm supports with cutters. Variety of standard sizes, from ⅞" to 2½" diameter, with 40 and 50 NMTB standard tapers.
HIGH PRECISION SOLID SPACING COLLARS available in six bore sizes . . . widths from .001" to 6".
STYLE "A" ARBORS with pilot end support, permit clearance along arbor when small cutters are used for light work. Standard sizes from ⅞" to 1¼" diameter, with 40 and 50 NMTB standard tapers.
ADJUSTABLE SPACING COLLARS for quick and easy adjustment between cutters . . . save setup time.

For fast, accurate milling at lower cost, it pays to use Scully-Jones *precision built* Arbors!

You save tool life because your cutters always run true, each tooth taking its share of the load. Arbor and pilot diameters are held to +.0000″, −.0005″. Faces of spacers and sleeves are ground and lapped parallel within .0002″. Taper shanks are ground to a finish of from 10 to 20 micro-inches, RMS, and are individually checked on light gages to assure a perfect fit in the spindle.

You save tooling costs, too, because Scully-Jones Arbors are made to take a lot of punishment. Manufactured from steel forgings, they're tough on the inside to provide maximum strength and minimize vibration . . . hard on the outside to resist nicking and wear.

Call your factory-trained Scully-Jones representative or distributor for fast service on milling arbors, adapters, sleeves, and spacing collars . . . as well as other Scully-Jones "Precision Holding" Tools.

When you buy or *build* a machine tool, make sure it's equipped with Scully-Jones "Precision Holding" Tools.

SCULLY JONES

SCULLY-JONES

"Precision Holding" for holding precision

Scully-Jones and Company, 1906 So. Rockwell St., Chicago 8, Ill.

THERE'S A SCULLY-JONES PRECISION TOOL FOR EVERY HOLDING AND DRIVING NEED

For more information on products advertised, use Inquiry Card, page 255

Product Directory

To find headings easily, look for capitol letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

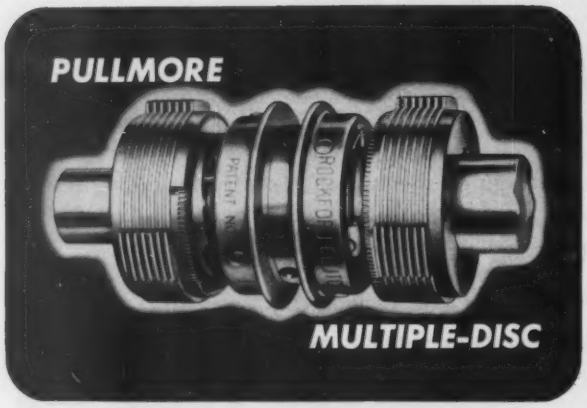
ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

ROCKFORD



DOUBLE OR SINGLE TYPE APPLICATIONS

COMPACT DESIGN
HIGH TORQUE
HIGH-RATIO LEVERS
POSITIVE NEUTRAL
PRECISION BUILT
LONG WEAR LIFE
EASY ADJUSTMENT

* These compact, powerful, multiple-disc clutches are helping product engineers to reduce size and weight of the vital link between the driving and driven units of machine tools, lift trucks, overhead cranes and a wide variety of other production equipment. They readily fit into product designs, accommodating great torque capacity within small size. Precision grinding insures perfect fit on the clutch shaft. Symmetrical contours avoid drag that is caused by centrifugal force.

Send for This Handy Bulletin
Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications.
Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
▲ 410 Catherine Street, Rockford, Illinois, U.S.A. ▲

CLUTCHES

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

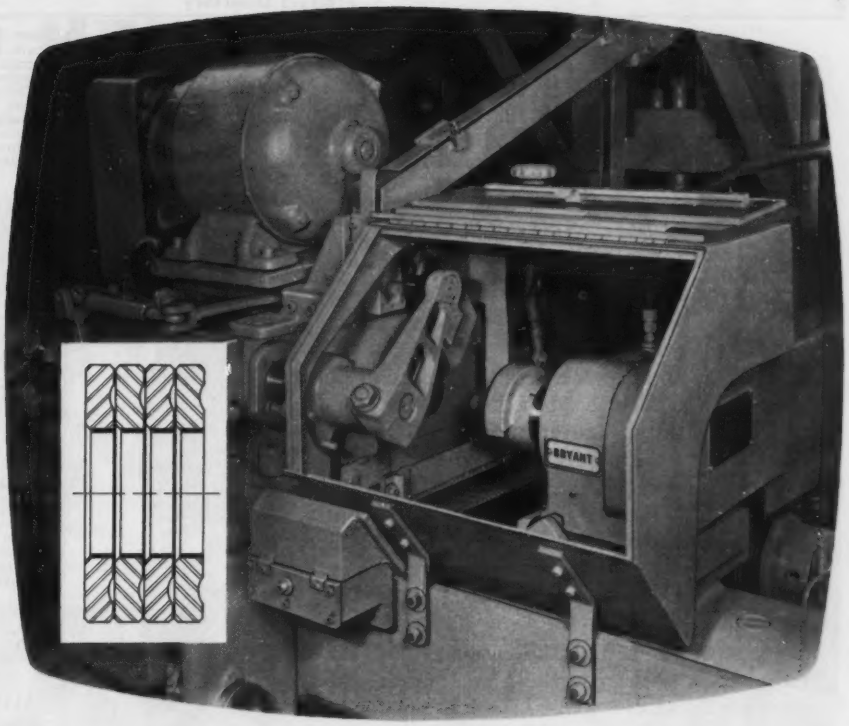
ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

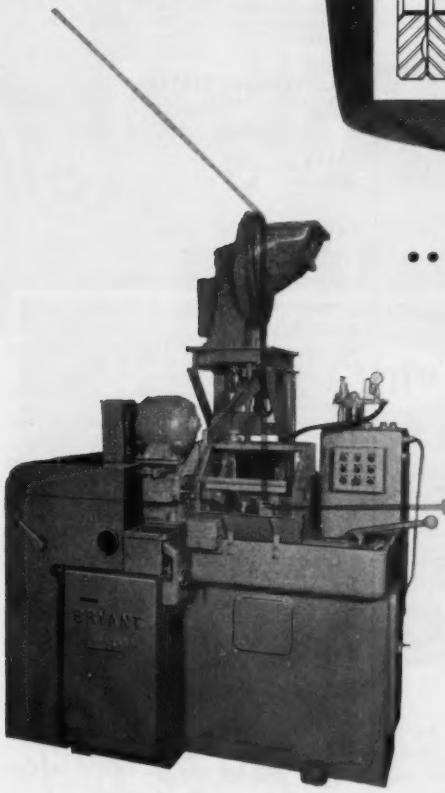
ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

(*Continued on page 282*)

CUT HIGH COSTS





...with BRYANT automatic internal grinders

This grinding operation demonstrates how Bryant Grinders can be integrated into production lines for maximum efficiency.

In this operation, four thrust bearing rings are ground internally, at one chucking, on a Bryant 2209D with hopper and stacker attachments. The rings (which have been ground on both faces in the previous operation) pass from an overhead conveyor into the hopper. The stacker then groups them in fours for loading by the automatic loading device. A clamp chuck holds the rings while they are ground—520 per hour, at 100% efficiency, to 1.003/1.005". .012" to .017" stock is removed—to the required 20 micro-inch finish. Diamond sizing automatically controls the tolerance requirements.

The discharge device then removes the rings from the chuck and places them on a second conveyor which carries them to the next operation.

Bryant grinders offer you operating economy—as well as peak production rates. Their precise alignment helps ensure maximum accuracy and minimum maintenance—factors that cut cost per piece.

Write for our "Alignment" booklet. Ask, too, for a reservation card for our new sound, color movie "Alignment for Better Internal Grinding"—free showings arranged for engineering groups.

BRYANT

chucking grinder co.

SPRINGFIELD, VERMONT, U.S.A.

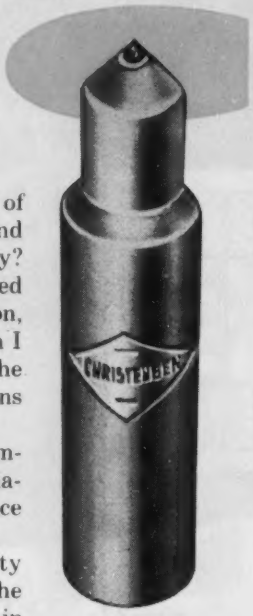
Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

The point is . . .

HOW MUCH DOES IT COST

NOT TO INVESTIGATE?



Most diamond tools are similar in quality of diamonds used, precision manufacture and price; how do you determine which to buy? Ask yourself these questions: First, do I need a special tool designed for special application, or will a standard tool fit my needs and am I getting the most for the money spent on the dressing tools I now use or could my operations be improved.

We are selling diamond tools but more important we are selling the application of diamond tools. With your help we try to reduce costs by fitting the tool to the job.

Perhaps we have never had the opportunity of working with you on your problem, but the experience we have gained in helping others in similar situations gives us a broader view point to help you with your problems and the basis on which to build our recommendations.

Write us explaining your problems. Ask yourself this question: How much does it cost not to investigate?

CHRISTENSEN **Christensen Diamond Tools**

division of **CHRISTENSEN DIAMOND PRODUCTS**

Send for the new catalog of Christensen Diamond Tools

Christensen Diamond Products
1937 South Second West
Salt Lake City, Utah

☐ Send catalog. ☐ Send catalog and contact me concerning recommendations of the application of your diamond tools in our plant.

NAME.....

ADDRESS.....

CITY.....

Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Casa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Maching Co., Philadelphia, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mich. Tool Co., 2531 11th St., Rockford, Ill.

BALL BEARING TESTERS

Micrometrical Mfg. Co. 321 S. Main St., Ann Arbor, Mich.

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

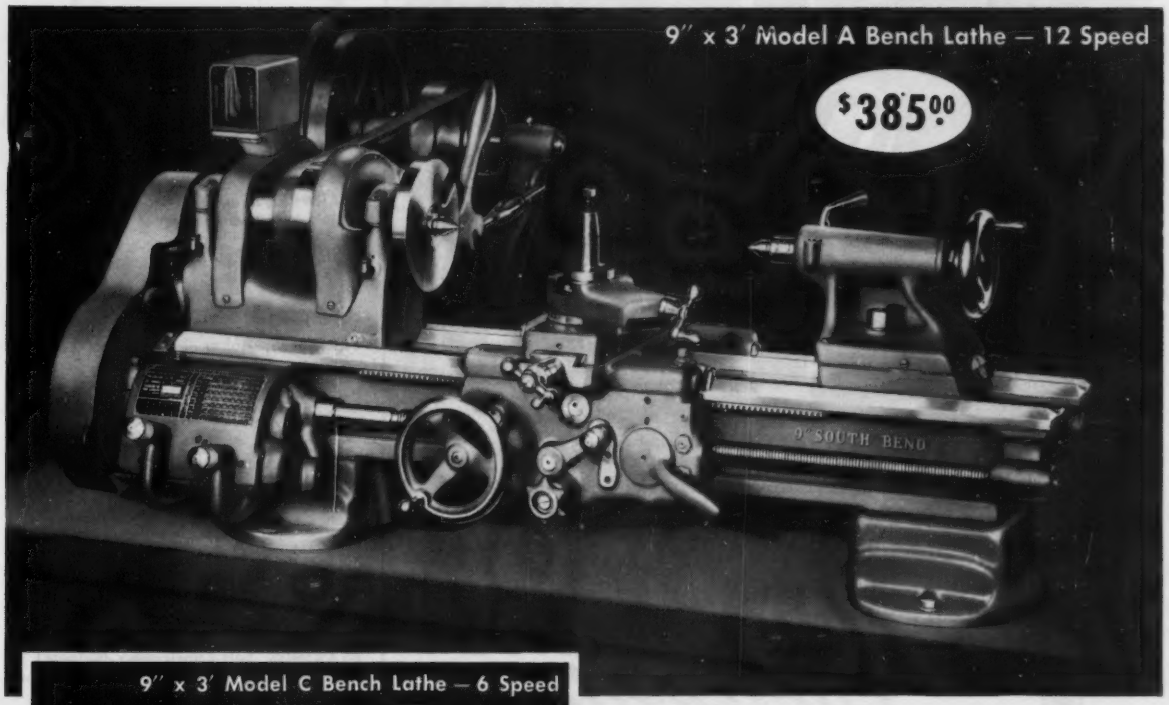
BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Torrington Co., Torrington, Conn.

(*Continued on page* 284)

For more information on products advertised, use Inquiry Card, page 255

HERE'S MORE FOR YOUR MONEY



South Bend 9″ Lathes represent far greater value than their moderate prices indicate. They are exceedingly accurate, quickly adaptable to a wide variety of work and built to give long, dependable service. These quality features can be offered because of the production economies resulting from volume manufacturing.

We sincerely believe that they represent more actual dollar-for-dollar value than any other lathe made. Evidence of this lies in the fact that they have out-sold all others. You'll be surprised at the many places these lathes can be efficiently worked into your production plans. Now is the time to have our distributor give you complete information.

NEW CATALOG

Describes 9″ to 16-24″ Lathes, ½″ and 1″ collet Turret Lathes, 14″ Drill Presses, 7″ Bench Shapers and Pedestal Grinders. Ask for Catalog 5406.

(Prices shown are f.o.b. factory, less electrical equipment.)

Compared with our costs
OUR PRICES ARE LOWER
than they were back in 1941

Prices are closely tied to costs. Costs are still rising. Buy now before increased costs necessitate higher prices.

PLEASE SEND INFORMATION CHECKED:

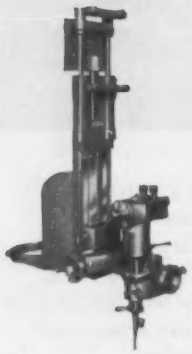
☐ 9″ and 10″ BENCH LATHES ☐ 10″ to 16-24″ FLOOR LATHES ☐ DRILL PRESSES ☐ ½″ & 1″ Collet TURRET LATHES ☐ TOOL GRINDERS ☐ 7″ BENCH SHAPERS

Name_____ Street_____

City_____ State_____

Building Better Tools Since 1906 • **SOUTH BEND LATHE** • South Bend 22, Indiana

GOODRICH HYDRAULIC



Duplicators
Duplicators

Convert Your Machinery for Profitable Tool Room Work— or Mass Production . . . .

Beat competition . . . modernize shop facilities with an inexpensive replacement program. Costly milling and hand finishing are eliminated.

This sturdy Hydraulic Duplicator adapts quickly to small or large operations . . . tolerances are held to precision limits for master pattern and template work without constant checking. The Duplicator shuts off when straight machine operation is desired.

Simplifies . . .

Milling • Planing • Grinding • Contouring • Die Sinking • Boring

GET ALL THE FACTS WITHOUT OBLIGATION

SEND FOR FREE FOLDER A-2

Manufactured By
Automotive Service Tools Inc.
Division of LANSING DIE SINKING CO.
617 May Street Lansing, Michigan

BEARINGS, Bronze and Special Alloy
Bunting Brass & Bronze Co., Spencer & Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Railway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilless)
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

BELTING, Transmission
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

(Continued on page 286)

For more information on products advertised, use Inquiry Card, page 255

A IR engineering at work
REPORT No. 4400.05

Running Ten Nuts at a Crack...

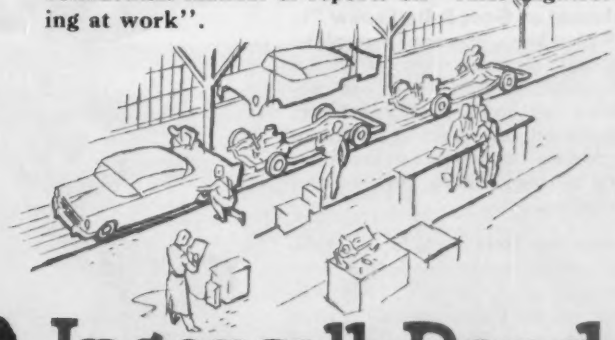
SAVES $12,000 *a year!*

This large auto manufacturer formerly used two ¼ ton presses to position a differential carrier in the rear axle housing. Then the ten ⅜" nuts were run individually. Only experienced operators could control torque so that it met specifications. Naturally the engineers wanted to eliminate the press operation and improve torque control.

AIR engineering by Ingersoll-Rand provided the answer and saved $12,000 a year. A 10-Spindle Multiple Nut Runner is now suspended over the moving conveyor. The differential carrier is hand set on the housing, and dropped to within ⅛" of its final location. The 10-spindle nut runner quickly and accurately draws it into final position as it runs all 10 nuts at once . . . and to the required 50 ft. lbs. torque. The press operation is eliminated, and simultaneous running of the nuts eliminates binding.

If you are in any way responsible for cutting costs in your plant, write us on your company letterhead, and we will arrange for you to see I-R's confidential manual of reports on "AIR engineering at work".

Ingersoll-Rand Multiple Nut Runner runs 10 nuts at once, all to exact torque.



Ingersoll-Rand

11 Broadway, New York 4, N.Y.

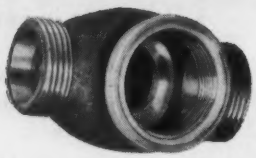
AIR engineering Manual

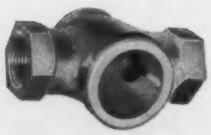
Don't miss over 100 interesting case history applications of AIR engineering in this confidential manual.

8-147

More completely finished parts at the end of the day with no partly finished pieces lying around is the regular accomplishment of Goss & De Leeuw "1-2-3" chuckers. It means complete finishing on one, two or three ends simultaneously or in sequence without tool resetting, rechucking or parts handling. Machining operations may include boring, facing, turning and threading.

Change over from job to job is simple. Cost-cutting is assured on long or short runs. Goss and DeLeeuw Chucking Machines are the only standard machines of their type which operate the "1-2-3" way to reduce costs per piece and step up the number of pieces per hour.





Investigate the opportunities offered by these machines on your production by sending samples of your work for time and cost estimates—Ask for illustrated descriptive literature.

GOSS & DELEEUW
QUALITY PRODUCT-QUANTITY PRODUCTION

GOSS and DeLEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 565 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

BENDING MACHINES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

BLUING LAYOUT
Dykem Co., 2303P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Bethlehem Steel Co., Bethlehem, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

(*Continued on page* 288)

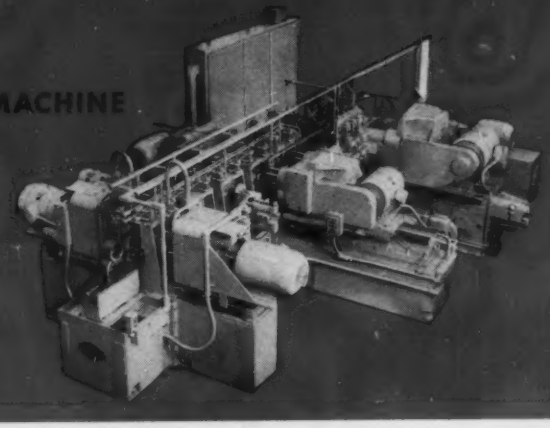
For more information on products advertised, use Inquiry Card, page 255

10 Station Automatic In-Line TRANSFER MACHINE

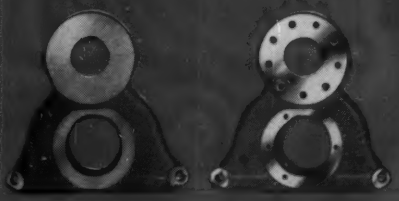
BAKER

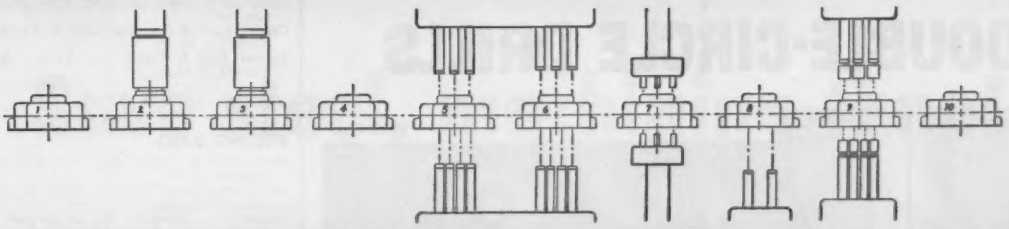
Performs Multiple Operations on Automobile Housings

THE MACHINE



THE PART





THE OPERATIONS

STATION NO. 1
LOAD 1 PART

STATION NO. 2
UNIT NO. 1
COMB. SEMI. FIN. BORE 5.165 & 3.249 & 2.861 DIAS.
COMB. SEMI. FIN. BORE 4.425 THRU BOTH WALLS

STATION NO. 3
UNIT NO. 1
COMB. FIN. BORE 5.180 & 3.264 & 2.876 DIAS.
COMB. FIN. BORE 4.440 THRU BOTH WALLS

STATION NO. 4
IDLE

STATION NO. 5
UNIT NO. 2 "U" DRILL 5 HOLES
31/64 DRILL 6 HOLES

UNIT NO. 3 31/64 DRILL 8 HOLES
21/32 DRILL 1 HOLE
"U" DRILL 6 HOLES
23/32 DRILL 1 HOLE

STATION NO. 6
UNIT NO. 2 ½ CHAMFER 5 HOLES
⅝ CHAMFER 6 HOLES

UNIT NO. 3 ⅝ CHAMFER 7 HOLES
13/16 CHAMFER 1 HOLE
½ CHAMFER 6 HOLES
23/32 DRILL 1 HOLE
COMB. COUNTERBORE
.796 & CHAMFER 1 HOLE

STATION NO. 7
INSPECTION

STATION NO. 8
UNIT NO. 4
.6910 REAM 1 HOLE
.8157 COUNTERBORE 1 HOLE

STATION NO. 9
UNIT NO. 5 7/16-14 N.C. TAP 5 HOLES
9/16-12 N.C. TAP 6 HOLES

UNIT NO. 6 7/16-14 N.C. TAP 6 HOLES
9/16-12 N.C. TAP 7 HOLES
½-14 N.P.T. TAP 2 HOLES

STATION NO. 10
UNLOAD 1 PART

Whatever Your Specific Job Problem, Consult Baker Engineers. Write

BAKER BROTHERS, INC., TOLEDO, OHIO

QUALITY...
Quality that delivers more cutting mileage. There's quality in the raw materials . . . in the design . . . in the craftsmanship . . . all of which are doubly assured by our rigid inspection. These are drills for top production!
CHICAGO LATROBE
DOUBLE-CIRCLE DRILLS
SERVICE
*GUN DRILL
You can rely on your CHICAGO-LATROBE DISTRIBUTOR for fast delivery and service . . . Consult him on your technical problems, too. Through his close relation with our factory, he can deliver what you need when you need it.
CONTACT THE CHICAGO-LATROBE DISTRIBUTOR IN YOUR AREA. OVERNIGHT SERVICE ANYWHERE.
DOUBLE CIRCLE TOOLS
Chicago-Latrobe
417 W. ONTARIO STREET, CHICAGO 10
DRILLS • REAMERS • COUNTERSINKS • COUNTERBORES • CARBIDE TOOLS • SPECIAL TOOLS

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING AND TURNING MILLS, Vertical

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

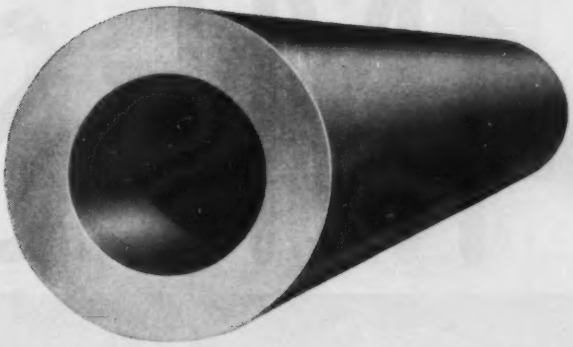
BORING, DRILLING AND MILLING MACHINES, Horizontal
(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.

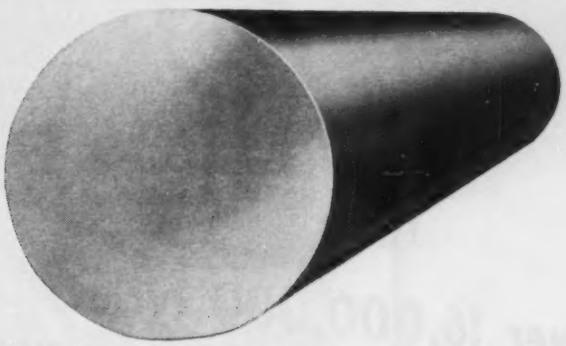
(*Continued on page* 290)

When you make hollow parts . . .

Start with seamless tubing



instead of bar stock



Save steel, machining time!

WHEN you make hollow parts from bar stock, you waste time boring the center hole—you waste steel because you have to throw away the chips you bore out. Why not do it the easy, economical way? Start with Timken® seamless tubing. The hole's already there! Finish boring is often the first production step. You cut machining time—get more parts per ton of steel.

With Timken seamless tubing, your machine tools are more productive. Screw machine stations normally used for drilling can be released for other jobs. You get added machine capacity without additional machines.

To make sure you save even *more* steel, our engineers will study your problem and recommend the most economical tube size for your hollow parts job, guaranteed to clean up to finish dimensions.

You also get the highest internal quality with Timken seamless tubing. The piercing process by which it's made is basically a forging process. Result: a uniform spiral grain flow for greater strength and a refined grain structure which brings out the best quality of the metal. And the Timken Company's rigid control keeps the quality uniform from tube to tube and heat to heat. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

AMES

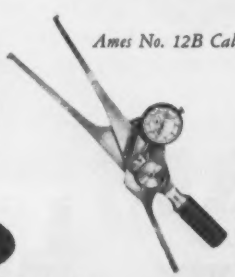
Over 16,000,000 cycles without wear or loss of accuracy . . . how many more will they complete?

Several Ames Long Range Dial Indicators *with plain bearings* are currently giving an amazing demonstration of performance and endurance under test. Several Model 282 Indicators, selected at random from our stock, still have their original accuracy – after more than 16,000,000 cycles each, at 240 strokes a minute, 9 hours a day.

This outstanding record is made possible by Ames' use of simple basic design, highest quality materials, rugged construction . . . and expert craftsmanship.

How many more cycles will these Ames indicators complete?

Ames No. 2 Dial Comparator



Ames No. 12B Caliper Gauge

Ames No. 552 Dial Micrometer

If you would like to have our recommendations on your measurement problem, send blueprints and specifications. And ask for your free copy of our catalog on Ames micrometer dial indicators and gauges.

Representatives in principal cities. B. C. AMES CO. 27 Ames Street Waltham 54, Mass.

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Mummert-Dixon Co., Hanover, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Simplex Machine Tool Corp., 4528 W. Mitchell St., Milwaukee, Wis.

BORING MACHINES, Jig

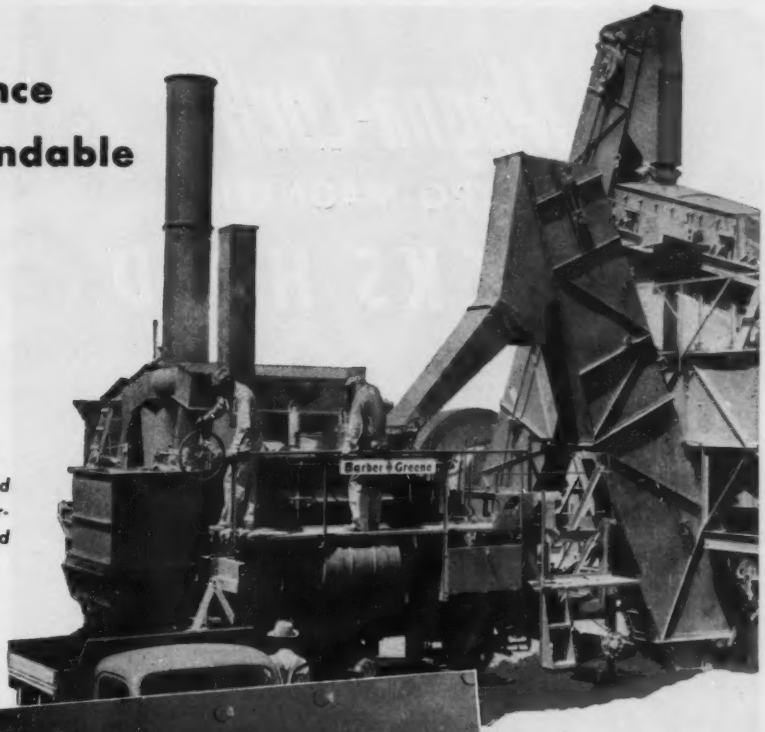
American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

BORING TOOLS

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.

(*Continued on page 292*)

machines of great performance use the most dependable oiling system ever developed



A Model 50 Madison-Kipp Lubricator installed as original equipment on a Model 848 Barber-Greene Asphalt Mixing Plant manufactured by Barber-Greene Co., Aurora, Illinois.

MADISON-KIPP *Fresh Oil*

. . . by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy where oil under pressure fed drop by drop can be installed.

There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U. S. A.

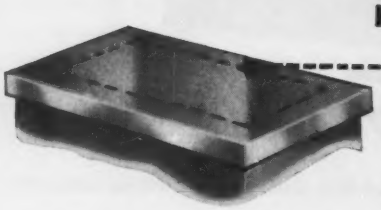
• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

Magna-Lock

ELECTRO-MAGNETIC

CHUCKS HOLD

22% MORE HOLDING ----------AREA



Fine poles permit holding small work pieces, too.

This extra margin of holding power holds an extra margin of profit for you!

Get details, DEPT. M-15

Request Magna-Lock as original equipment on your new machines

Hanchett MAGNA-LOCK CORPORATION

Magnetic Chucks and Devices

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Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss, E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. Y.

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American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
duMont Corp. (Hand, for Keyway cutting) Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

BULLDOZERS

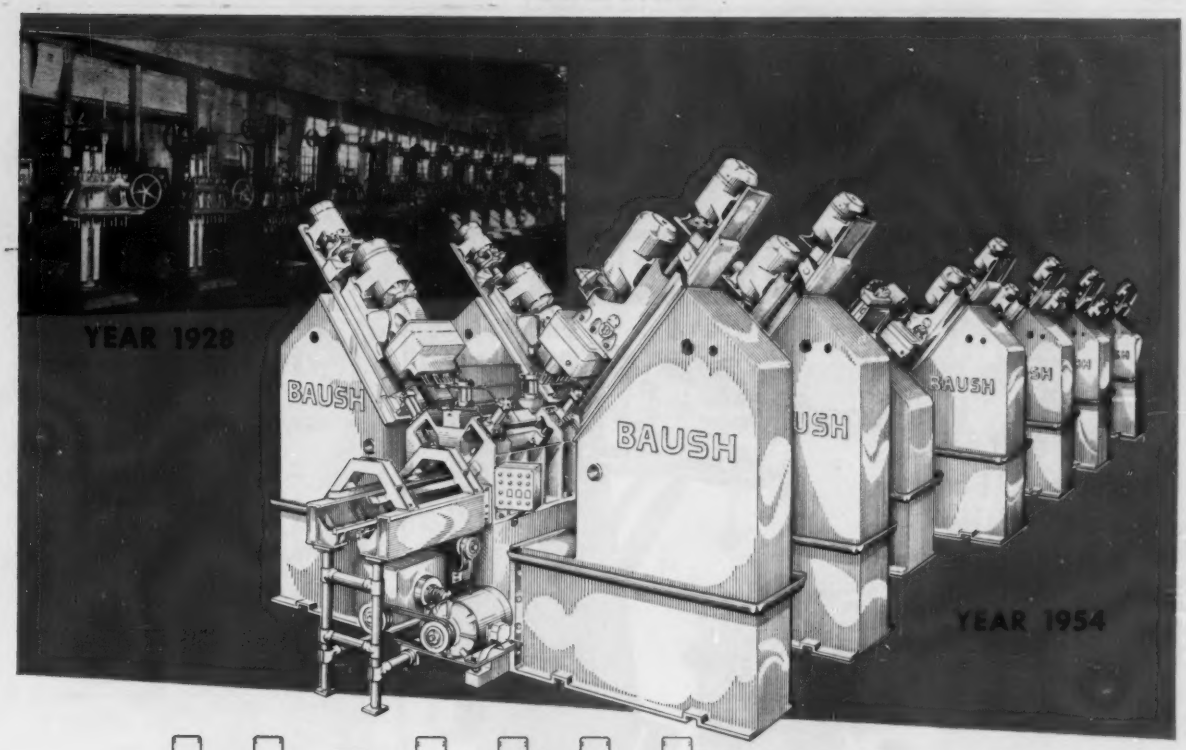
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

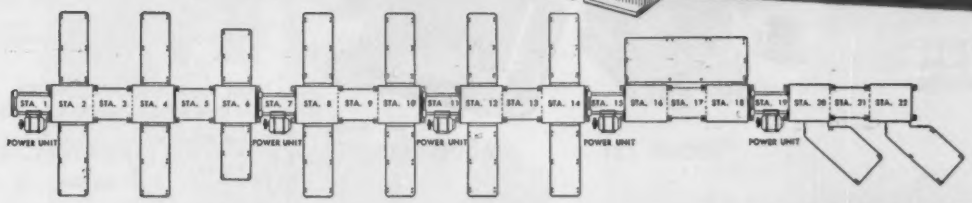
BURS

See Files and Burs, Rotary

(*Continued on page* 294)

For more information on products advertised, use Inquiry Card, page 233





EXCLUSIVE BAUSH TRANSFER FEATURES:
Either mechanical or hydraulic

1. Individuality of each machine.
2. Accurate leveling of one machine to another not important.
3. Each machine has individual electrical panel. Simple as way-type machine.
4. One or more machines can be added to line if more operations are desired.
5. Line can be broken and automatic index, checking, or roll-over fixtures added.
6. Give maximum production with minimum maintenance.
7. Readily adapted to automation.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

BAUSH

TRANSFER MACHINE

completes 12,600 operations per hour to

MINIMIZE **. . . Labor Costs**

MAXIMIZE **. . . Production**

This 22-station automatic transfer — designed for specific operations on a new V-8 engine — is another example of Baush ingenuity and "know-how" in machine tool construction.

Transfer consists of 22 stations with 5 complete machine sections with 14 Model "S" Leadscrew Units and 2 Hydraulic Units.

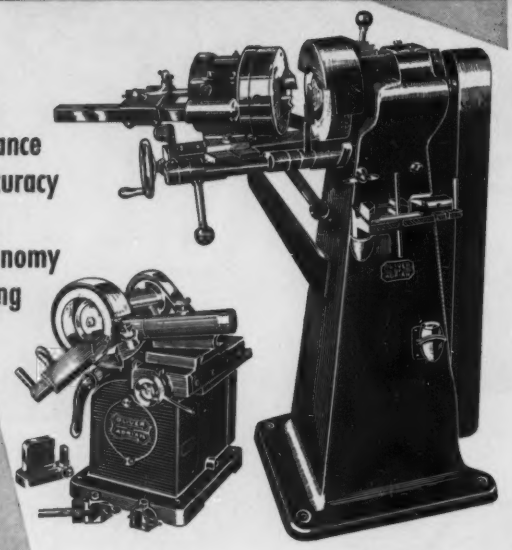
There are five 4-position Transfer Sections with arch fixtures and bushing plates — 2 checking fixtures — power units for transfer — hydraulic loading and clamping of part and 16 Fixed Center Ball Bearing Heads having a total of 105 spindles to complete 12,600 operations to drill, core-drill, chamfer and ream 120 cylinder blocks per hour.

Look—What YOU Get

with

OLIVER DRILL POINTERS

- perfect DRILL balance
- positive DRILL accuracy
- longer DRILL life
- greater DRILL economy
- faster DRILL cutting



BE WISE OLIVERIZE

MODEL #21 MODEL #510

OLIVER DRILL POINTERS uniformly machine grind all drills to a perfect balance — each lip of the drill doing equal work. Because the unique OLIVER feature provides the only scientifically correct and theoretically perfect drill point each drill lasts from 2 to 3 times longer than ordinary hand-ground drills.

Drills machine ground the OLIVER way cut faster and more accurately . . . produce more perfect holes. Avoid costly lags in production schedules by eliminating excessive drill breakdowns and *dull drill* slowdowns. Improve the wearing life of your drills . . . at the first sign of dullness remove them and machine sharpen them . . . with an OLIVER DRILL POINTER.

No. 510 for drills ¼" to 3"—2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.
No. 21 Oliver Bench Grinder. Hand operated for Drills No. 57 to ½". Right hand, with an improved point. Attachments are available for grinding oil hole drills, left hand and other special points.

Write for our free Booklet
"How To Produce More Holes With Your Drills!"
See our catalog in Sweet's Directory

MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES

OLIVER INSTRUMENT CO.
1410 E. MAUMEE • ADRIAN, MICHIGAN

BUSHINGS, Brass, Bronze, Carbide, Etc.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened
Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig
Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS
Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springeld, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

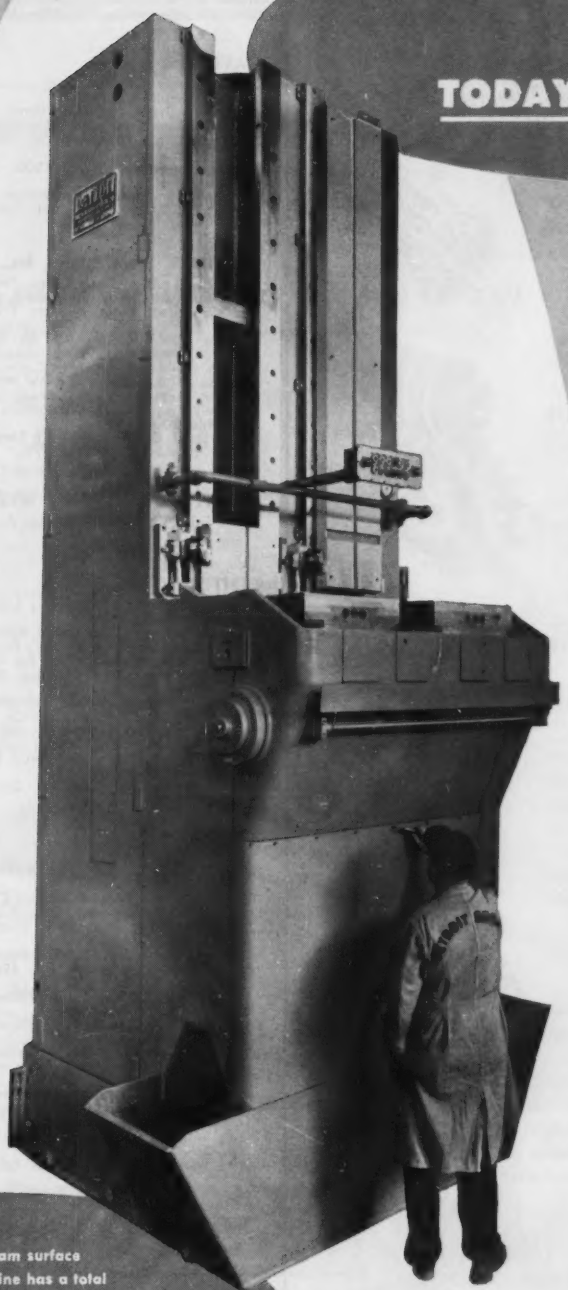
CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernor Hwy., Detroit 1, Mich.

CASEHARDENING FURNACES
See Furnaces, Heat-Treating

(*Continued on page 296*)

Detroit BROACHING MACHINES

BUILT FOR TODAY'S and Tomorrow's BROACHING NEEDS



This huge dual ram surface broaching machine has a total tolerance of .0005" run out throughout its 100" stroke. Machine was designed and built to lick a particularly tough broaching problem . . . furnished with complete carbide tooling.

Detroit Broach is building the finest in broaching machines . . . machines that are designed to make easy the broaching of today's "miracle metals." All of the experience and knowledge obtained from many years as a pioneer and leader in the design and manufacture of broaching tools has gone into the development of these "years ahead" machines.

Detroit broaching machines are sturdy and rugged in construction . . . designed to withstand high broaching speeds in the toughest of metals. The complete line is available in a wide range of sizes with strokes from 6" to 100". Many advanced engineering features are incorporated, such as oilgear hydraulic equipment, automatically adjusted shuttle tables and precision slides.

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For many years specialists in broaches and broach tooling exclusively, Detroit has unmatched experience and facilities to offer for broach tooling also. Thus, you can place complete responsibility for your entire broach needs in the hands of one competent organization. The result is consistently greater production economy, efficiency and precision.

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Get all of these ☑ ADVANTAGES!

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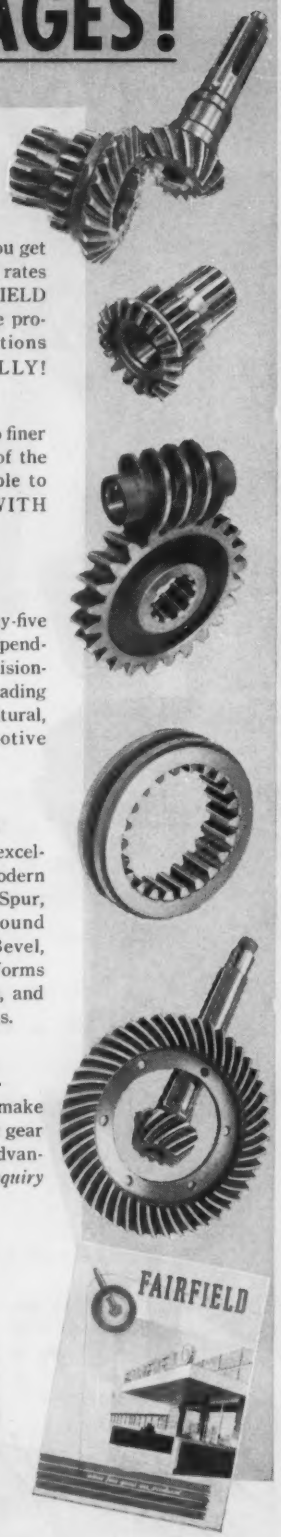

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☑ **QUALITY PLUS**—There is no finer recommendation for the quality of the product you sell than to be able to say that it is "EQUIPPED WITH FAIRFIELD GEARS!"

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☑ **COMPLETE PRODUCTION FACILITIES**—Fairfield offers unexcelled facilities in a new and ultra-modern plant for producing finest quality Spur, Herringbone, Spiral Bevel, Ground Tooth Spiral Bevel, Straight Bevel, Coniflex Bevel, Hypoid, Zerol, Worms and Worm Gears, Splined Shafts, and Differentials to your specifications.

☑ **ENGINEERING SERVICE**—Fairfield engineers are qualified to make expert recommendations on your gear production requirements. Take advantage of the service offered. *Your inquiry will receive prompt attention.*

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Fine Gears Made to Order

Send for a copy of this illustrated bulletin describing Fairfield's facilities for making gears.

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Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die

American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, Iron

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel

Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe

Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Dakon Tool & Machine Co., 496 Broadway, Brooklyn, N. Y.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

(*Continued on page* 298)

NOW . . . a BROACHING MACHINE *for every shop!*

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LAPOINTE

4 small sizes

BROACHING MACHINES

- LOW IN PRICE
- SMALL
- FAST
- ACCURATE

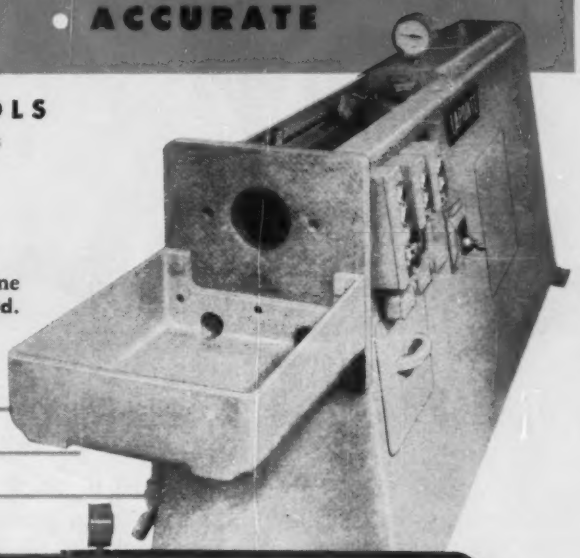
For the smaller shops and tool rooms, here's an all-purpose, universal broaching machine built with LAPOINTE precision — **for precision work.**

it has PUSH BUTTON CONTROLS

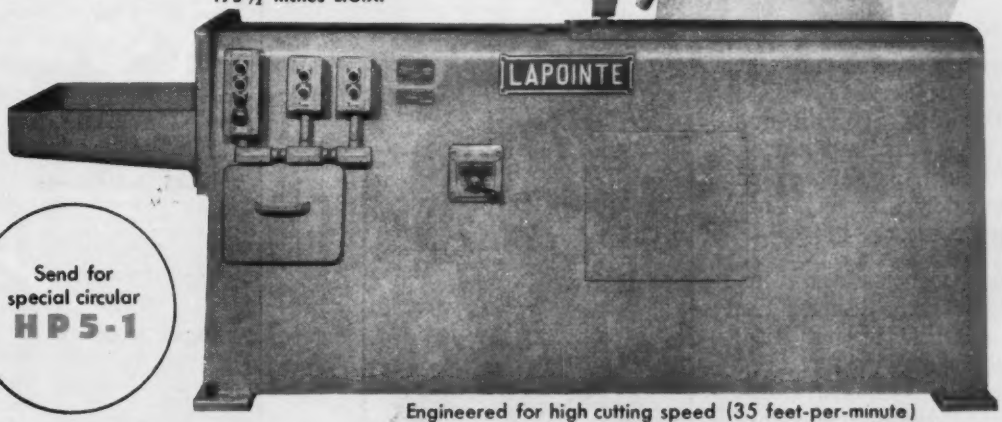
and other features found on the big machines, such as
automatic limit switches
variable speed
wide face plates

PRICED LOW

and inexpensive to maintain, here's a broaching machine that practically every shop can use and **any shop can afford.**



FOUR SIZES	
HP-5	2½ ton pull, 30-inch stroke, 115½ inches L.O.A.
HP-5	2½ ton pull, 48-inch stroke, 151½ inches L.O.A.
HP-10	5 ton pull, 48-inch stroke, 151½ inches L.O.A.
HP-10	5 ton pull, 60-inch stroke, 175½ inches L.O.A.



Send for special circular **HP 5-1**

Engineered for high cutting speed (35 feet-per-minute) and high return speed (100 feet-per-minute) it's perfect for small work *where fast production with accuracy is essential!*

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THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

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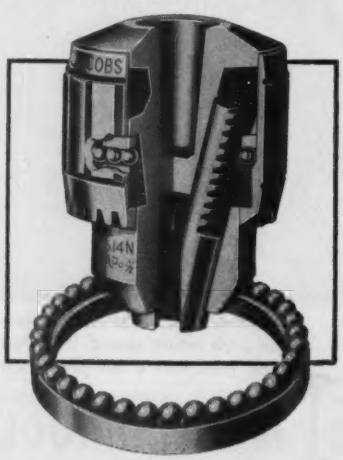
Try the Jacobs Ball Bearing Super Chuck. It's a heavy duty chuck for heavy duty drilling . . . a bear for grip and 100% more powerful than comparable plain bearing chucks.

Here's why. The ball thrust bearing rolls away friction between sleeve and nut. Steel jaws close smoothly with tremendous power. The Jacobs Ball Bearing Super Chuck grips harder, and more accurately than any other drill chuck made.



The Super Chuck and the complete line of Jacobs Chucks are stocked and sold by industrial distributors everywhere. See yours, or write Jacobs Mfg. Co., 1701 Jacobs Road, West Hartford 10, Conn. Ask for Catalog 100.

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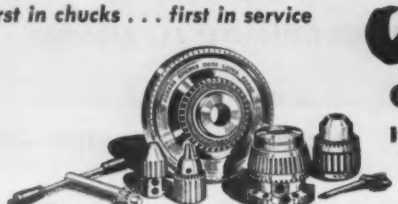
are ready to deliver the chucks you need and the service you deserve.
first in chucks . . . first in service



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If it's a Jacobs it holds

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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schraders Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split
See Collets

CHUCKS, Diaphragm
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

CHUCKS, Drill
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear
Gleason Works, 1000 University Ave., Rochester, N. Y.
Supreme Products, Inc., 2222 So. Columet, Chicago 16, Ill.

CHUCKS, Lathes, etc.
Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co. Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

(*Continued on page* 300)

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A COMPLETE LINE OF QUALITY cutting tools is now available from your Butterfield distributor. Taps are made to the same exacting standards as Butterfield Milling Cutters, Dies, Drills, Reamers, Counterbores and End mills.

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BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U.S.A.

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Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
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DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

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McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

CLAMPS

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Brown & Sharpe Mfg. Co., Providence, R. I.
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Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

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Standard Pressed Steel Co., Jenkintown, Pa.

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Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

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Eastman Kodak Co., Rochester, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

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Oakite Products, Inc., 19 Rector St., New York, N. Y.
Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

COMPOUNDS, Resin and Moulding

General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Pillipsburg, N. J.

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Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

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Blanchard Mch. Co., 64 State St., Cambridge, Mass.
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Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
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(*Continued on page* 302)

for the first time!

a single cylinder

FOR AIR OPERATION OR STANDARD 1000 P. S. I. OIL SERVICE

Complies with BOTH J. I. C. Pneumatic and J. I. C. Hydraulic Standards!

- New Series "S" Hydro-Line Cylinders
- 95% efficient at 100 PSI air pressure
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- Compact, flexible design
- Advanced design of cushions in the Series "S" make it possible to use the full stroke on these cylinders at higher speeds and loads than the conventional type.

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hydro-line *Manufacturing Co.*

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For more information on products advertised, use Inquiry Card, page 255

NEW *Grip-Tip* CENTERS

CHECK THESE *Grip-Tip* FEATURES

- Long-Life Holders
- Replaceable Carbide Tips
- Easy Insertion and Removal of Male or Female Tips
- Reduced Machine Down-Time
- Lower Cost for Replacement of Carbide Tips
- Carbide Tips Accurate to .0005"
- No Regrinding of Holder
- Carbide Tips Are Easy and Inexpensive to Stock
- Reduced Regrinding Time
- Longer Diamond Wheel Life

with REPLACEABLE CARBIDE TIPS

Grip-Tip Centers are specifically designed to substantially reduce your replacement costs and machine down-time for regrinding or replacement of worn or chipped centers.

Male or female carbide tips are inserted or removed from the tool steel holders by simply turning a screw. The unique clamping action of holders on tips is positive and quick . . . you save replacement time with Grip-Tip Centers.

The life of Grip-Tip holders is practically unlimited, for, only the dull or chipped carbide tips are reground. Because the steel holder is not ground when sharpening the carbide tip there is less clogging and longer life for your diamond wheels. Also, the relatively inexpensive double end tips in both male and female types can be stocked with a minimum investment . . . Grip-Tip Centers reduce tool and inventory costs.

Grip-Tip Centers increase your production by permitting full utilization of machine tools. It takes but a minute to remove old carbide tip and replace with a new one . . . machine down-time is less with Grip-Tip Centers.

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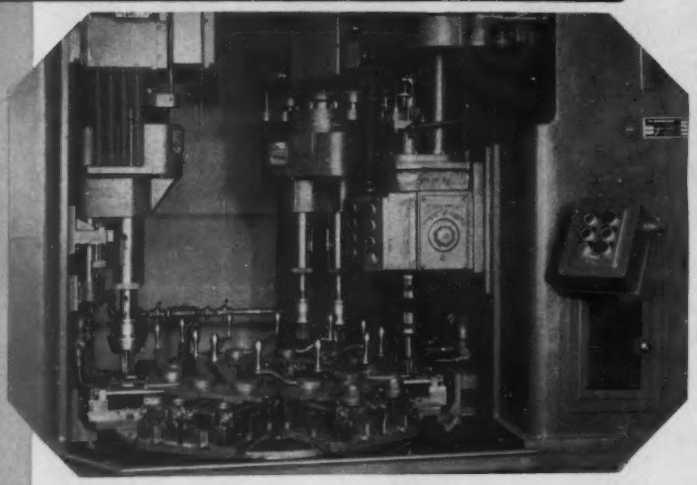
D R & T COMPANY

Another Cleveland Design to Speed Production!



COMBINATION CLEVELAND REAMING AND TAPPING MACHINE

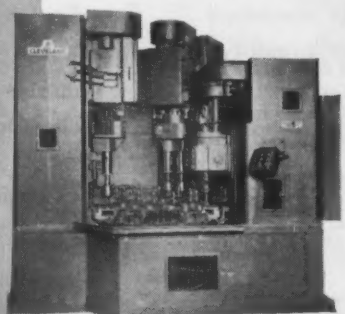
OPERATION: Rough taper ream two parts at a time. Finish taper ream two parts at a time. Tap with taper pipe tap two parts at a time.

PARTS: Union End Forgings.

PRODUCTION:

Size	Parts Per Cycle	Prod. at 100% Efficiency
1¼"-11½	2	316 per hour
1½"-11½	2	256 per hour
2"-11½	2	200 per hour

A vertical combination machine consisting of a heavy duty Cleveland 21" Power Index Table, mounted on an all welded and normalized steel base with columns on the rear of the table supporting two drill units, each with a two spindle head and one Cleveland Model F-2 two spindle heavy duty tapping unit.



Mounted on the top plate, twelve hand operated locating and clamping fixtures, with interchangeable jaw sets.

Write today for Catalog No. MY-15

CLEVELAND tapping machine co.

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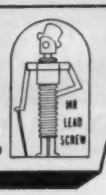

Fellows Gear Shaper Co., Springfield, Vt.
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Hartford Special Machry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONTROLS, Thermo

Control Products, Inc., 306 Sussex St., Harrison, N. J.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9.

COOLANT SEPARATORS

See Separators, Oil or Coolant.

COUNTERBORES

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp. Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

(*Continued on page* 304)

For more information on products advertised, use Inquiry Card, page 255

Universal Drill Bushings are available in a complete range of standard sizes and lengths. Special sizes made to order. Vastly increased production facilities assure immediate deliveries. Write to the office nearest you, Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.

Universal products include: Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holders, Mikro-Lok Boring Bars, Standard Drill Bushings, and Universal Index Plungers. Write for catalog.

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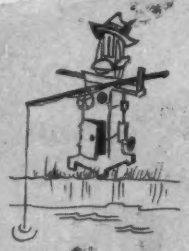
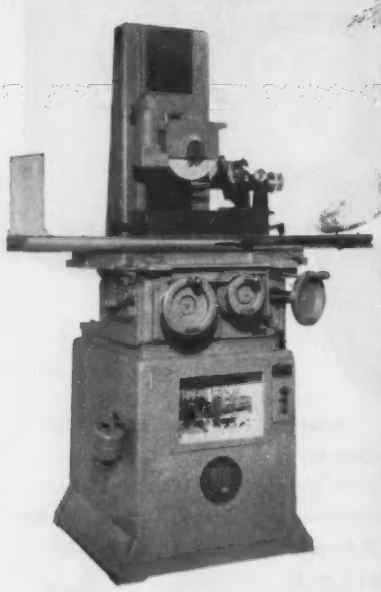
UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2, MICHIGAN

"How about a RETIREMENT PLAN for OVER-AGE Grinders?"

Actually it's a sensible ideal for recent surveys show that ONE out of every FIVE grinders now in operation is eligible for retirement, being incapable of meeting today's precision tooling standards.





Rarely must you pay a heavy premium in efficiency and profits, modern management finds that it makes sense to put over-age machines out to pasture, replacing them with REID Surface Grinders . . . for REID Grinders are famed as precision Grinders, preferred by industry for dependable accuracy.

Your REID Dealer will show you how easy and economical it is to replace over-age Grinders with modern, efficient, REID Precision Surface Grinders.

PLAN NOW FOR REPLACEMENT

with REID GRINDERS

For the complete story on Reid Surface Grinders please write for Bulletin 618-2.

Reid Brothers Company, Inc.

BEVERLY, MASSACHUSETTS

COUNTERS, Revolution
Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S., Co., Athol, Mass.

COUNTING DEVICES
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS, Flexible
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrell-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.

COUPLINGS, Shaft
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Sier-Bath & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear
Brown & Sharpe Mfg., Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St., Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Threadwell Tap & Die Co., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Eelctric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich. (Thread)
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

(*Continued on page* 306)

For more information on products advertised, use Inquiry Card, page 255

Logan RFL unit

Keeps Your Air-Operated Equipment Working At Full Capacity

MAINTAINS UNIFORM AIR PRESSURE, FILTERS AIR, LUBRICATES AIR CYLINDERS, VALVES, TOOLS

To assure capacity performance under all conditions, install the new Logan "R-F-L Unit" wherever air power is used in your plant and on the equipment you are marketing. Uniform working pressure is maintained by leveling out surges and sudden drops in the air supply. Clean, moisture-free, oiled air is supplied to assure unfailing operation, minimize wear of working parts, and increase service life of packings. The R-F-L Unit is installed in the intake line from the main air line, and can be mounted on a central control panel. Its compact, clean lines harmonize with the modern styling of your latest equipment. All components are conveniently visible on and controlled from the front panel. The upper and center knobs regulate the air pressure and oil flow, respectively—the lower knob drains the water trap.

FUNCTIONAL FEATURES

- Long life-piston-type reducing valve with long travel for accurate regulation of air pressure. Pressure gauge.
- Lubricator with control knob, oil level sight glass and filler plug located on front panel of unit.
- Removable ribbon-type air filter element to trap scale, rust, other foreign matter and water. Large water reservoir.

WHAT IT DOES

REGULATOR—Piston-type reducing valve with long travel of control permits accurate regulation of pressure from main air line as required by work. Keeps working pressure uniform with minimum air consumption.

FILTER—Supplies clean, dry air to system, thus assuring uniform and trouble-free operation. Replaceable filter element separates scale, rust and other foreign matter from air. Moisture drips into a reservoir which requires draining only once or twice a week.

LUBRICATOR—Automatically injects oil into air intake line to lubricate valves and cylinders, prevent corrosion and increase life of parts and packing. Metering needle adjustable as required by installation.

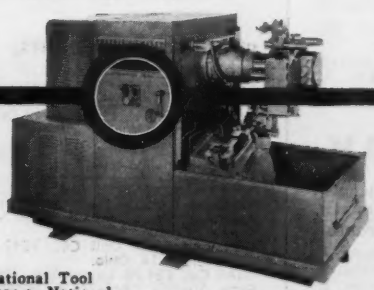
Eliminates piping, elbows, tees and reducers between components. No pipe friction.

HOW IT IS CONTROLLED

Two knobs on front panel accurately regulate air pressure and amount of oil injected as required by the individual job.

HOW IT IS INSTALLED

Install in the air intake line from the main air line. Can be mounted on a central control panel.



Illustrated — Single spindle automatic chucking machine with Logan R-F-L Unit installation. Photo courtesy Warner & Swasey Co.

Member—National Tool Builders Assn.; National Fluid Power Assn.

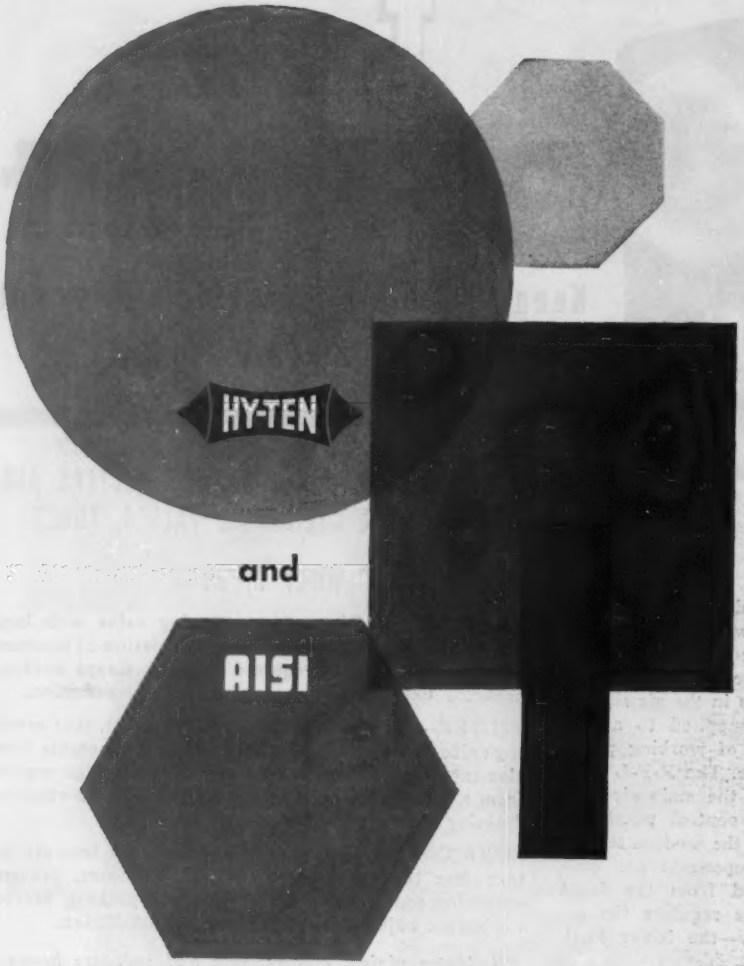
Logan

LOGANSPORT MACHINE CO., INC.
810 CENTER AVE., LOGANSPORT, IND.

Let Logan engineers help you design your Air and Hydraulic Circuits. No obligation.

AIR CONTROL VALVES, Cat. 100-4 • AIR CHUCKS, Cat. 70-1 • AIR CYLINDERS, Cat. 100-1 • AIR-DRAULIC CYLINDERS, Cat. 100-3
AIR and HYDRAULIC PRESSES, Cat. 51 • COLLET GRIP TUBE FITTINGS, Cat. 200-5 • HYDRAULIC CONTROL VALVES, Cat. 200-4
HYDRAULIC CYLINDERS, Cats. 200-2; 200-3 • HYDRAULIC POWER UNITS, Cat. 200-1 • SURE-FLOW COOLANT PUMPS, Cat. 62

For more information on products advertised, use Inquiry Card, page 255



bars, billets and forgings in sizes, shapes and treatments for every need!

Wheelock, Lovejoy & Company, Inc., can fill your alloy steel requirements promptly. This applies to both standard AISI and SAE steels and to our own HY-TEN steels—"the standard steels of tomorrow". Take advantage of our seven strategically located warehouses. All of them can supply these steels in the form and quantity you need. Every warehouse, too, is staffed with expert metallurgists who are ready to serve you.

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138 Sidney Street, Cambridge 39, Mass.

Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Verner Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burrs, Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shear-Speed Chemical Products, Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa., (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel

Allison Co., Bridgeport, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614 G. N. Lexington Ave., Pittsburgh 8, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

CUTTING-OFF MACHINES, Cold Saw

See Sewing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

(*Continued on page* 308)

For more information on products advertised, use Inquiry Card, page 255

We put Hydraulic Cylinders on a reducing diet

RESULT:

The New VICKERS® "Compact" HYDRAULIC CYLINDERS

For 2000 PSI Working Pressure

Everybody agreed that hydraulic cylinders were just too fat . . . took up too much space. So our engineers put them on a reducing diet. The result . . . these slim, powerful, "Compact" cylinders fit and work in spaces where the old type could not. It is part of Vickers long-time program of continuous improvement.

Among their many other features are: Multiple port positions. Spring-loaded synthetic-impregnated leather rod seal compensates for wear, assures long service. Piston seals are improved cup type. Tie rods are high tensile alloy steel. Adjustable integral hydraulic cushions are available. Comply with JIC standards. Conservatively rated for maximum working pressure of 2,000 psi. For further information, see Bulletin 54-68.

Waterbury Tool Division of Vickers Incorporated where "Compact" Cylinders are manufactured.

Ask for New Bulletin 54-68

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DIVISION OF SPERRY CORPORATION

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6950

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Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

CUTTING-OFF WHEELS, Abrasive

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air

Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co. Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Pneumatic

Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.

DEALERS, Machinery

Falk Machinery Co., 18 Ward St., Rochester, N. Y.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIAMONDS AND DIAMOND TOOLS

Christensen Diamond Prod., 1937 S. Second West, Salt Lake City, Utah
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die

DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., Div. U. S. Industries, Inc. 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Grob, Inc., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

DIE SETS, Standard

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danley Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St. Racine, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

DIE STOCKS

See Stocks, Die

DIES, Sheet Metal, Etc.

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks. 683 Northland Ave., Buffalo, N. Y.
Richard Bros., Div., Allied Products Corp., 12619 Burt Rd., Detroit 23, Mich.
Taft-Pierce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Waltham Mch. Wks., Newton St., Waltham, Mass.

DIES, Threading

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave. Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment

DOYELL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.

(*Continued on page* 310)

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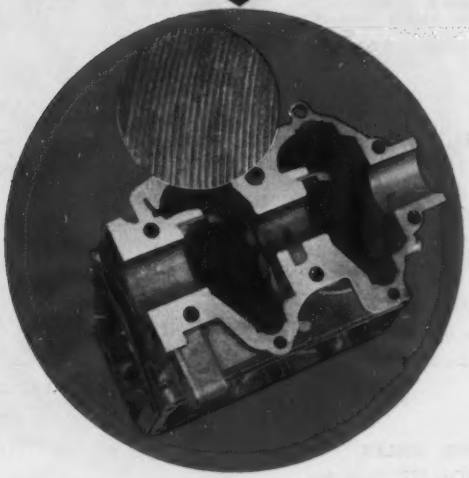
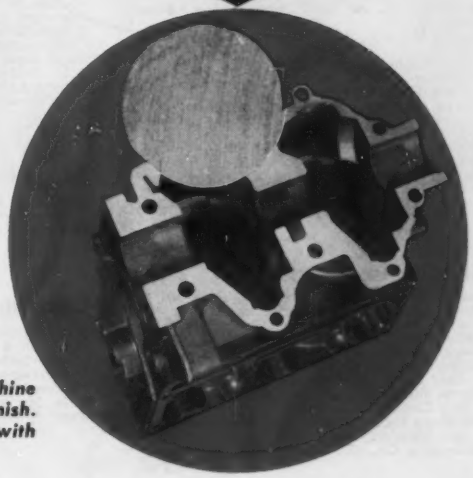


standard milling machine produces a 125 micro inch machine finish. Part was milled at 40 ipm, at 1,200 RPM cutter speed.

Four times smoother finish when part is milled with Onsrud high speed, high feed milling machine . . .



Onsrud A-245 Milling Machine produces a 32 micro inch finish. Part was milled at 70 ipm with cutter speed of 7,500 RPM.

HERE'S PROOF!

. . . that high spindle speeds are needed for effective milling of non-ferrous metals. Here is a graphic demonstration of one of the important advantages of Onsrud high speed milling machines . . . the advantage of smoother, finer finish at high production speeds. The part machined was an aluminum alloy outboard motor cylinder block. Since Onsrud milling machines are specially built for non-ferrous milling, you will find them consistently faster and more accurate for every type of milling job. Your inquiry for complete information is invited. We will be happy to supply a production analysis without charge.

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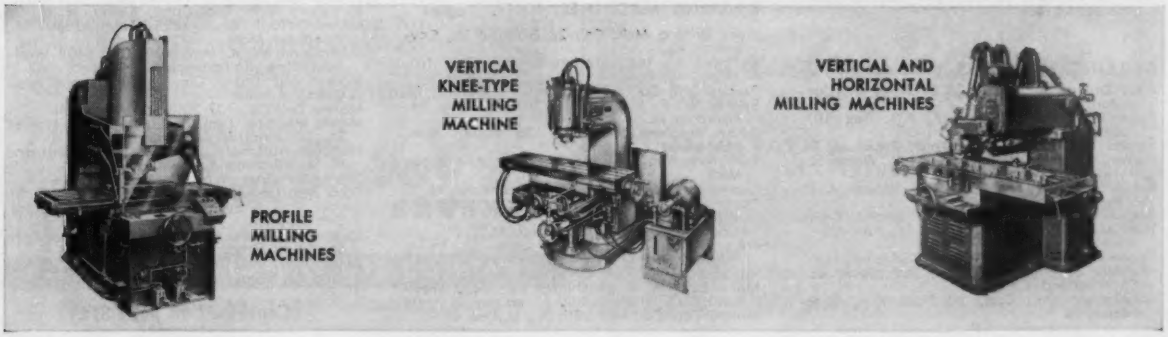

DRIFTS, DRILL

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Etto Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Govro-Nelson Co., Detroit 8, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STOPS

Wahlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

DRILLING MACHINES, Automatic

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros. Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch. Co., 126 E. Third St., Covington, Ky.
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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

DRILLLING MACHINES, BOILER

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.

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Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

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Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
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Barnes W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
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Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
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Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

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Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
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Barnes, W. F. & John, Co., 201 S. Water St. Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry, Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., Scuth Bend, Ind.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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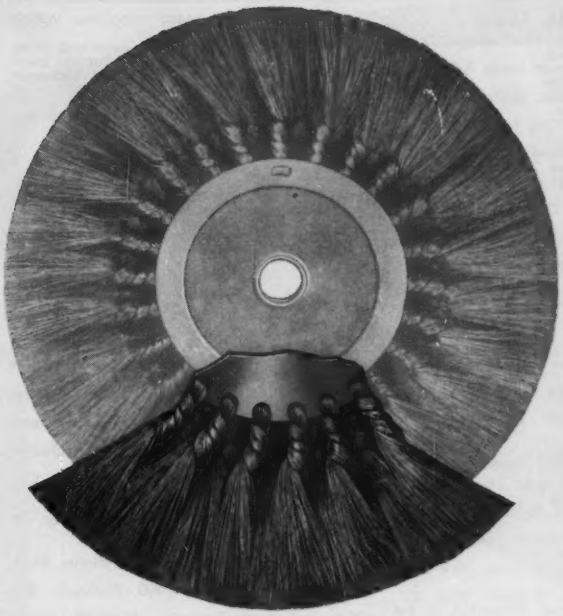

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Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foot-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

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DRILLING MACHINES, Sensitive

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Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
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Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
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Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
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Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works, 3817 St. Clair Ave., N.E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

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Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
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Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
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Keo Cutters, 19326 Woodward, Detroit, Mich.
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Corboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McGrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
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Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
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Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
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Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Spade

Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.

DRILLS, Twist

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
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(*Continued on page* 314)

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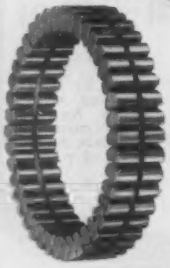

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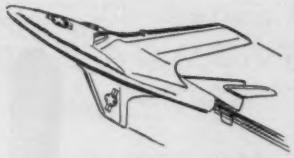

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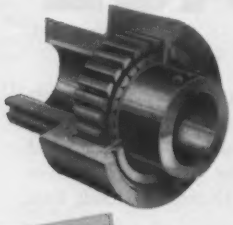
Versatility of performance—wide range of sizes—make it possible for over 3,000 users in every type of industry to get the advantages of Formsprag Clutches accuracy, long life, and smooth operation.



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(*Continued on page* 316)

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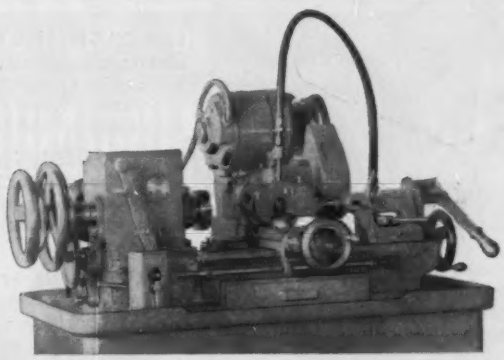

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For profitable small part thread milling—use the Waltham Thread Miller. We have recently made a number of changes in the design of these machines that add to their operating efficiency and improve their appearance. New pedestal design eliminates need for having access to rear side, permitting machines to be placed back-to-back or against a wall. Spindle speeds are regulated from 0.5 to 5.75 rpm by easily accessible but covered pick-off gears.

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Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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(*Continued on page* 318)

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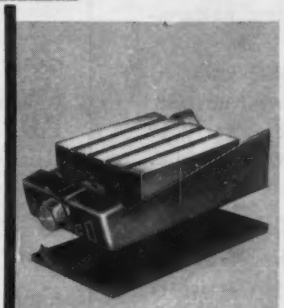
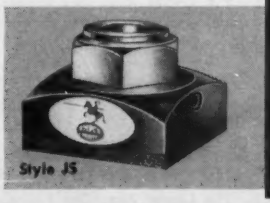


Style JD



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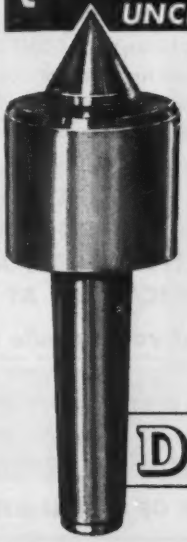

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Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co. Athol Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

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Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

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(*Continued on page 320*)

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Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

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Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
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See Speed Reducers.

GEAR SHAVING MACHINES

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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Chicago Rawhide Mfg. Co., 1309 Elston Ave., Chicago, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

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Micron Gear Mfg. Co., 102-38 Corona Ave., Corona, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 13, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Perkins Machine & Gear Co., West Springfield, Mass.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

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Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Chicago Rawhide Mfg. Co., 1309 Elston Ave., Chicago, Ill.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

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Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

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Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

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Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Die and Mold

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Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
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Mummert-Dixon Co., Hanover, Pa.

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Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

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Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
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Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
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(*Continued on page* 322)

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17 N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

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Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
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Union Twist Drill Co., Athol, Mass.

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Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

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See Flexible Shaft Equipment

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See Gear Grinding Machines

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.

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Gallmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
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Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
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Waltham Machine Works, Newton St., Waltham, Mass.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, 32, Mich.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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Pratt & Whitney, West Hartford 1, Conn.

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Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

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Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

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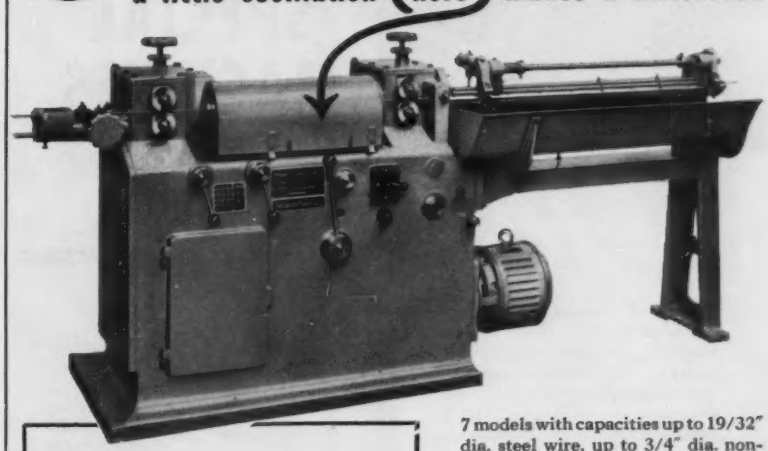
(*Continued on page 324*)

M R&P

AUTOMATIC WIRE-STRAIGHTENER AND CUTTER
a little oscillation (here) makes a difference



Oscillation

The MR&P straightening jig rotates, of course, but it also oscillates while wire is being cut. This is done to protect the material against breakage. Ordinarily, the heat and stress which are produced by the rotation of the straightening jig would be concentrated in one section of wire during a cut-off, but thanks to oscillation, it is distributed instead. Thus, the wire is protected, which is very important when straightening fine or brittle wires.

7 models with capacities up to 19/32" dia. steel wire, up to 3/4" dia. non-ferrous.

6 feeding speeds, up to 230 ft. of straightened and cut wire per minute.

Accurate: wire cut 40" long has length and straightness tolerances within ±.005".

Straightening jig has 2 different speeds: 4000 rpm and 6000 rpm.

2 pairs of feed rollers permit proper feeding of all kinds and sizes of wire. Soft material is not marked or deformed because of special elastic feeding pressures.

When straightening extremely fine and easily fractured wires, automatic clutch can be supplied for disengaging feed rollers during cut-off.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gollmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

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Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
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Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

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Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

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Pratt & Whitney, West Hartford 1, Conn.

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Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

GROOVE PINS

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 200 "G" St., Wilmington 99, Del.

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

HAMMERS, Portable Electric

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

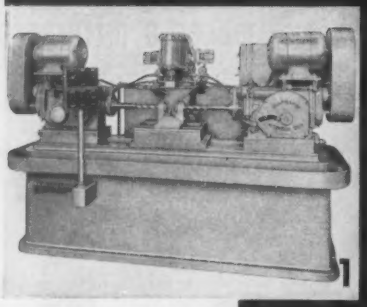
HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Shaft

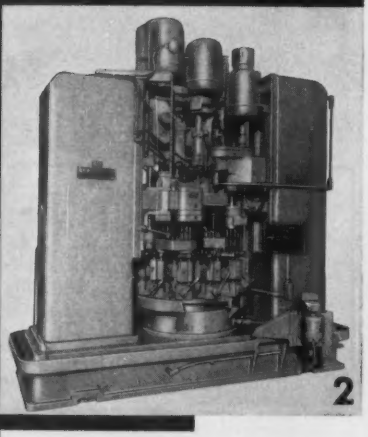
Standard Pressed Steel Co., Jenkintown, Pa.

MILLHOLLAND


1

SPECIAL MACHINES
— for your special jobs

Millholland design gives you standard machine flexibility and economy . . . special purpose efficiency . . . and toolroom accuracy. The unique plate type cam, with pneumatic counterbalance used in Millholland Automatic Units, keeps units removing metal 80% of total cycle time. Millholland designs and builds a wide range of machines and fixtures to solve your special production and tooling problems. Let us show you how we can help you combine, speed up and simplify any combination of rotary tool operations.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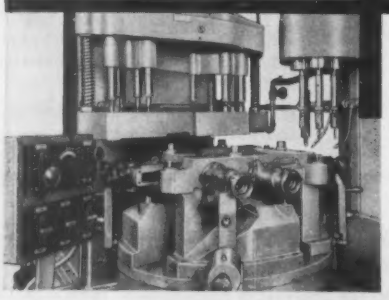


1. Many different parts are machined on this Double End Machine by changing fixtures, tools, V-belts and cams.
2. Millholland-designed fixtures enable this 12-station, 34-spindle vertical indexing machine to produce 93 pieces per hour.
3. Design features permit this 4-station vertical indexing machine to perform identical operations on two different steering gear housings without tooling changes.

Write for More Information on These Machines in Bulletin 116-M

W. K. MILLHOLLAND MACHINERY Co., Inc.
6402 Westfield Blvd., Indianapolis, Ind.

For more information on products advertised, use Inquiry Card, page 255

HAMMERS, Soft
Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Rawhide Mfg. Co., 1309 Elston Ave., Chicago, Ill.
Erie Foundry Co., Erie, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HARDENING EQUIPMENT
Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDNESS TESTING INSTRUMENTS
Olsen, Tinius, Testing Mch. Co., Philadelphia Pa.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

HOBBING MACHINES
See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HOISTING AND CONVEYING EQUIPMENT
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

HOISTS, Chain, Etc.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric
Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

HONING MACHINES, External
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.

HONING MACHINES, Internal (Cylinder)
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

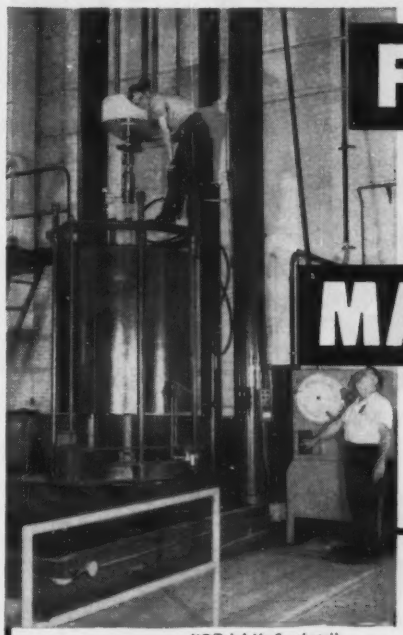
HONING STONES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HONING TOOLS AND FIXTURES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.

HOSE, Leather, Rubber, Metallic, Etc.
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

HYDRAULIC MACHINERY Tools and equipment
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.

(*Continued on page 326*)



FULMER HONING MACHINES

best and fastest for honing jobs on internal bores

"Official U. S. photo"

capacity up to 30 inch diameter in a 30 feet long cylinder

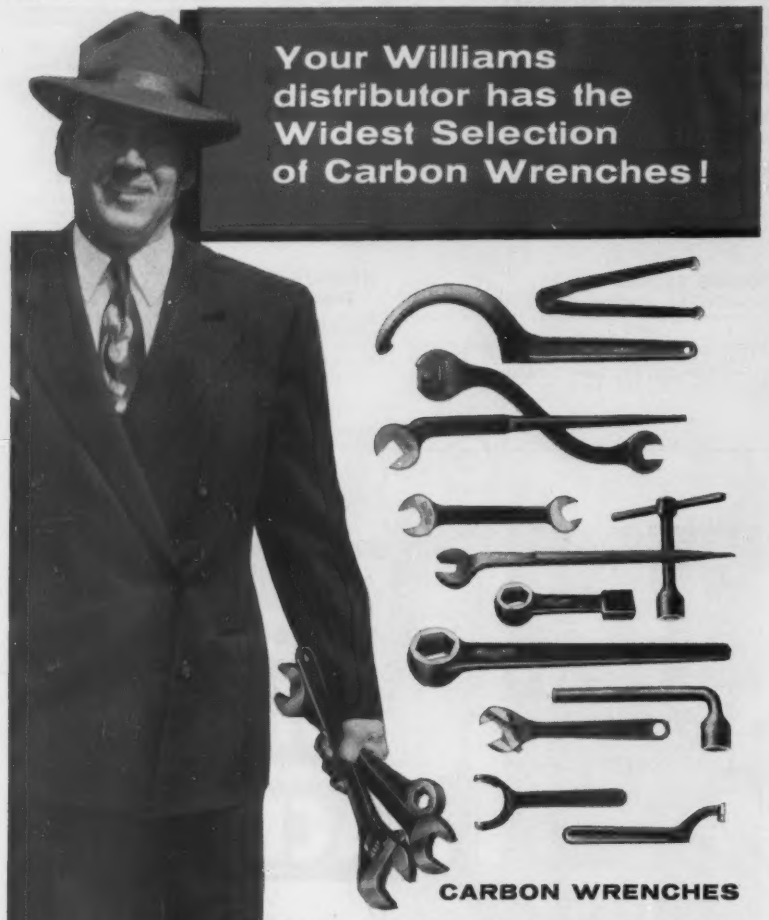
This shows one of the largest honing machines ever built capable of honing to AMAZING SMOOTHNESS a cylinder 30 feet long and 30 inches in diameter . . . about as tall as a two-story building. To allow for the extreme size the fixture is mounted on a table with the balance of the machine in a pit directly below.

FULMER HONING MACHINES hone internal bores of any size up to 30 inch diameter with strokes up to 84"—in ferrous or non-ferrous metals, glass, plastic and other materials.

Write for our bulletin on honing.

C. ALLEN FULMER CO.

1231 First National Bank Bldg. Cincinnati 2, Ohio



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you'll get SERVICE ON THE DOUBLE from your DISTRIBUTOR'S SALESMAN

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"The Broadest Line of Its Kind"

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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman, Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes John S., Corp., Rockford, Ill.
Barnes W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

INDEXING AND SPACING EQUIPMENT

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Swanson Tool & Machine Products, Inc., 854 E. 8th St., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

For more information on products advertised, use Inquiry Card, page 255

INDICATORS, Speed
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Micrometrical Mfg. Co. (Surface roughness & waviness) 321 S. Main St., Ann Arbor, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT
General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Hydro-Line Mfg. Co., 5764 Pike Rd., Rockford, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

JACKS, Machine Leveling
Enterprise Mch. Parts Corp., Detroit, Mich.

JACKS, Planer
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

JIG BORER
See Boring Machines, Jig.

JIGS AND FIXTURES
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

JOINTS
See Fittings, Hydraulic, Pneumatic, Etc.

KEYS, Woodruff, Machine, Special.
Standard Automotive Parts Co., 660-668 Nims, St., Muskegon, Mich.

KEYSEATERS
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester, 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page* 328)

an ACCO product

Wilson "Rockwell"* Hardness Testers

SET-O-MATIC* DIAL GAUGE

Eliminates human error. Operator merely applies minor load and taps depressor bar. No setting of dial to zero.

OTHER FEATURES

- **Major load applied under dash pot control**
- **Major load removed by motor**
- **Illuminated Dial Gauge**
- **Illuminated Penetrator**

Eliminates Operations... Increases Tests per Hour

All you have to do with the Model Y WILSON "ROCKWELL" Motorized Hardness Tester is apply the minor load and tap the major load depressor bar. The machine does everything else automatically. The cycle of Major Load operation may be less than 2 seconds.

This speed of test means great savings in time which will reduce your hardness testing costs. Yet it is done to Wilson's high standard of accuracy.

The utter simplicity of setting the SET-O-MATIC* dial gauge eliminates human error. The operator does not have to set the dial. The large pointer is automatically brought to "SET" position when the minor load is applied.

The Model Y Motorized WILSON "ROCKWELL" Hardness Tester is in production and orders are being accepted for early delivery. Write today for descriptive literature and prices.

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230-D Park Avenue, New York 17, N. Y.

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Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc., (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

LATHE AND GRINDING DOGS

Armstrong Bros. Tool Co. 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
Knapp, B. L., Ind. 107 N. Franklin Ave., Syracuse 4, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford. Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

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RIGID – ACCURATE – EFFICIENT – with a LARGER WORK AREA

This new press will give you greater production at lower cost. Its alloy iron frame has exceptional rigidity which holds deflection to a minimum and gives closer tolerances, greater uniformity and longer die life. Accuracy is also obtained through adjustable gibs of extra length. The rugged ram adjusting screw has buttress threads and replaceable hard bronze seat. Air clutch optional. Geared and non-geared models.

SPECIFICATIONS

Capacity — 75 tons. **Standard Stroke** — 4". **Maximum Stroke** (to order) — 8". **Strokes** per minute —42 (non-geared type 85). **Throat Depth** center of ram to frame—13½". **Die Space*** —14" to 22". **Bolster Plate Area**—36" x 26".

* bed to ram, standard stroke down, adj. up.

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Fully describes all L&J O.B.I. Presses — 21 geared and non-geared models. Capacities 8 to 90 tons. Also, 20 to 50 ton High Speed, Double Crank Straight Side Presses with speeds up to 450 s.p.m. Ask for Catalog L-12.

L&J PRESS CORPORATION
1631 STERLING AVE., ELKHART, INDIANA

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Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards, Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

For more information on products advertised, use Inquiry Card, page 255

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

Axelson Mfg. Co., P.O. Box 15335, Verona St., Los Angeles 58, Cal.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Hydro-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
Simmons Machine Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta. Los Angeles 58, Cal.
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Machine Tool Co., Springfield, Ohio.

LATHES, Hollow Spindle

Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type

Hydra-Feed Machine Tool Corp., 730 W. Eight Mile Rd., Ferndale 20, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom.

LATHES, Turret

Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Potter & Johnson Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.

LAYOUT FLUID

Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

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Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.

(*Continued on page* 330)

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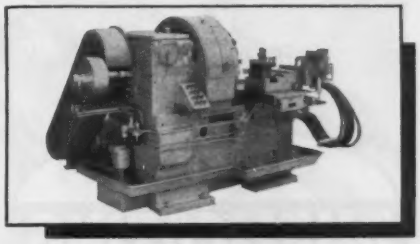

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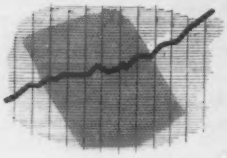

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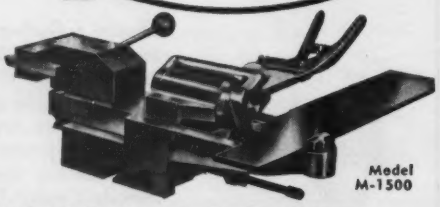

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Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINE KEYS

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINE PARTS, Special

Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINISTS' SMALL TOOLS

See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.

MEASURING MACHINES AND INSTRUMENTS, Precision

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Crane Parking Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Max Wyler, 611 W. 43rd St., New York 36, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Taft-Peirce Mfg. Co., Woonsocket, R. I.
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METAL FINISHINGS

Parker Rust Proof Co., 2194 E. Milwaukee, Detroit 11, Mich.

METERS

See Recording Instruments.

MICROMETERS

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co. Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

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MICROSCOPES, Toolmakers

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS

Brown & Sharpe Mfg., Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio.
Hardinge Bros., Inc., (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
U. S. Burke Machine Tool Div., Brotherton Rd. Cincinnati 27, Ohio.

MILLING, MACHINES, Circular, Continuous

Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Burke Machine Tool Div., Brotherton Rd. Cincinnati 27, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Brown & Sharpe Mfg., Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg., Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave., and Penn. R. R., Evanston, Cincinnoti, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexinton Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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(*Continued on page* 332)

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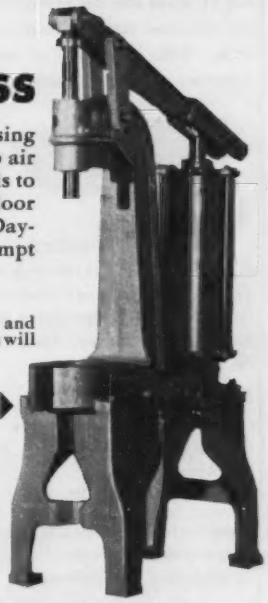

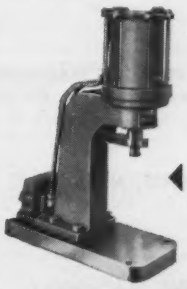

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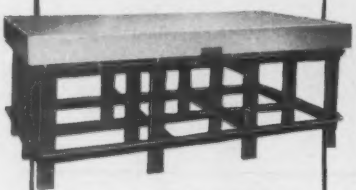

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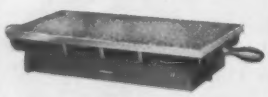

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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
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Consolidated Machine Tool Corp., Rochester N. Y.
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Gorton, Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt & Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
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MODEL AND EXPERIMENTAL WORK
See Special Machinery and Tools.

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Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MOLDING MACHINES, Plastic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric
Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motor Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

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NIBBLING MACHINES, Nickel
International Nickel Co., Inc., 67 Wall St., New York, N. Y.

NIPPLE THREADING MACHINERY
Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUT SETTING EQUIPMENT
See Screw Driving and Nut Setting Equipment.

NUT TAPPERS
See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap
Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp. (Union Drawn Steel Div.), Republic Bldg., Cleveland 1, Ohio.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-locking
Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

NUTS, Thumb or Wing and Cap
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Republic Steel Corp., Bolt and Nut Div., Republic Bldg., Cleveland 1, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS
Fischer Machine Co., 310 No. 11th St., Philadelphia, Pa.

OIL SEALS
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F. 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F. 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.

For more information on products advertised, use Inquiry Card, page 255

Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

OILS, Soluble

See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

ORDNANCE MACHINES, Spelial

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

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Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

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Taft-Peirce Mfg. Co., Woonsocket, R. I.
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PLATES, Surface

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(*Continued on page 336*)

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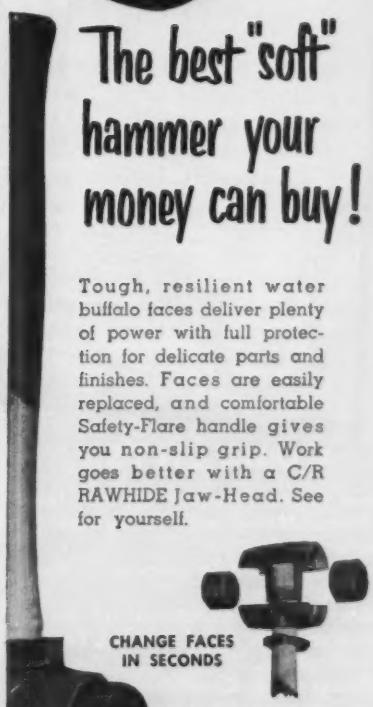

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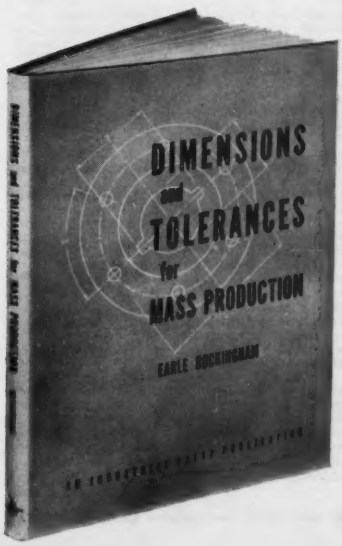

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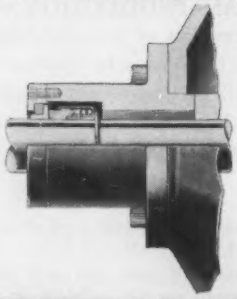

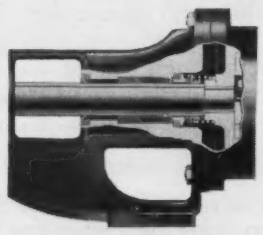

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Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
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Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
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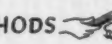
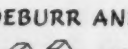
IT'S A SAFE BET YOU AREN'T DRIVING A 1925 MODEL BUT WHAT ABOUT GEAR DEBURRING? ARE YOU STILL USING SLOW AND COSTLY, OBSOLETE METHODS  TO DEBURR GEARS?

WHY NOT DEBURR AND CHAMFER THE ENTIRE TOOTH FORM  AUTOMATICALLY AT HIGH PRODUCTION RATES ON A MODERN BURR-MASTER? EITHER SPUR OR HELICALS; EXTERNAL OR INTERNAL; SPLINES TOO . . .

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National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
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Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
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Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
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Pope Mchry. Corp., Haverhill, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

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Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

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Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

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Republic Steel Corp., Niles Steel Products Div., Republic Bldg., Cleveland 1, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Bethlehem Steel Co., Bethelem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 Ave., Pittsburgh, Pa.
U. S. Steel Supply Div., U. S. Steel Co., 208 S. LaSalle St., Chicago 4, Ill.
Wheeler-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Oliver Bldg. Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge Mass.

(*Continued on page* 343)

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
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Vanadium Alloys Steel Co., Latrobe, Pa.
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Timken Roller Bearing Co., Canton, Ohio.
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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
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Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div.), 436 7th Ave., Pittsburgh, Pa.
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Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

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Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
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STEEL BARS

See Bars, Steel

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Starrett, The L. S., Co., Athol, Mass.

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Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

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Wohlnip Engineering Co., 390 Hillside Ave., Hillside, N. J.

(Continued on page 344)

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Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Threadwell Tap & Die Co., Greenfield, Mass.

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Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

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Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
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Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Springfield Mch. Tool Co., Springfield, Ohio.
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Torrington Co., Torrington, Conn.

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National Acme Co., 170 E. 131st St., Cleveland, Ohio.

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Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.
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McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
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Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
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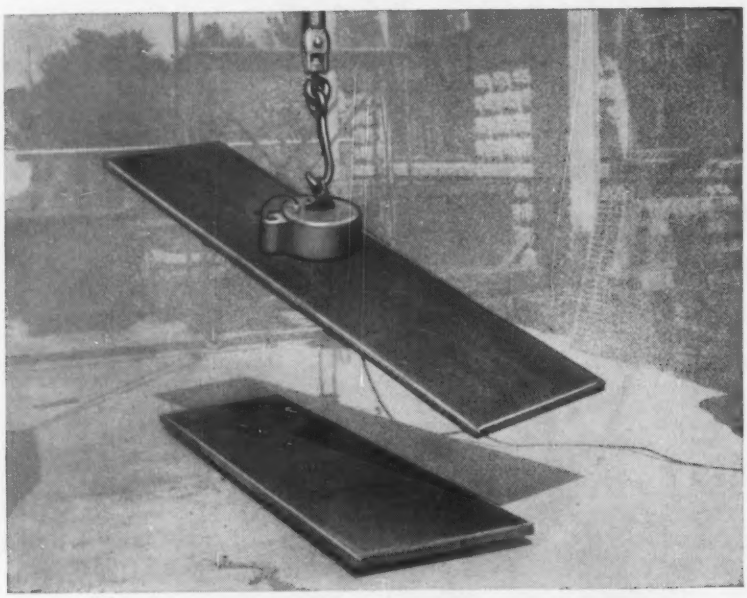

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Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

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Baker Bros., Inc., Station F, P.O. Box 101, Toledo 70, Ohio.
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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
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Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield, Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

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National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

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Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
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Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
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Morse Twist Drill & Mch. Co., New Bedford, Mass.
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Threadwell Tap & Die Co., Greenfield, Mass.

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Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
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Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
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Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
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Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
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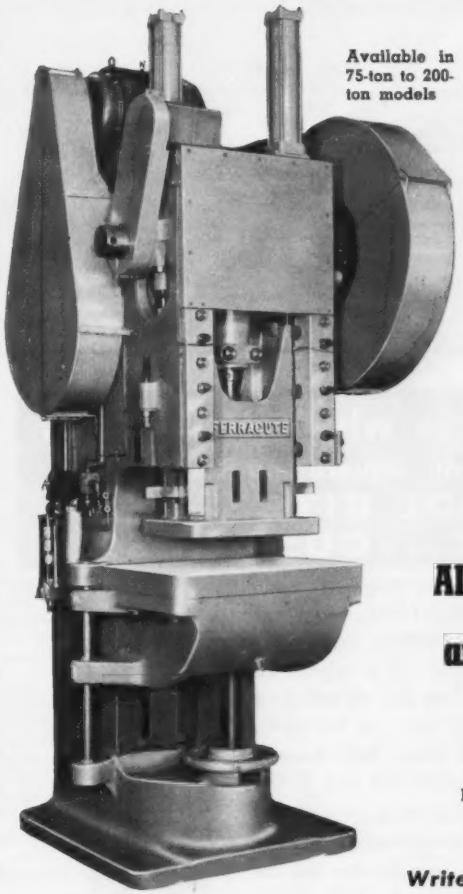
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page 346*)



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THREAD GRINDING MACHINES
See Grinding Machines, Thread

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Waltham Machine Works, Newton St., Waltham, Mass.

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National Acme Co., 170 E. 131st St., Cleveland, Ohio.

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Landis Machine Co., Waynesboro, Pa.
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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
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Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
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Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
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Vanadium Alloys Steel Co., Latrobe, Pa.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Kennametal, Inc., Latrobe, Pa.
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(Continued on page 348)

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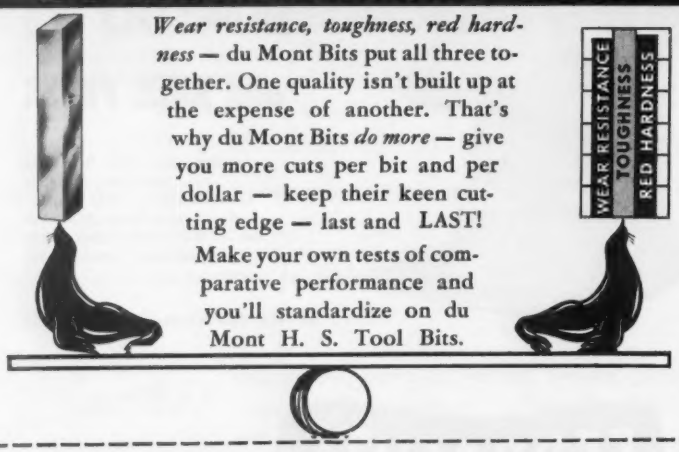

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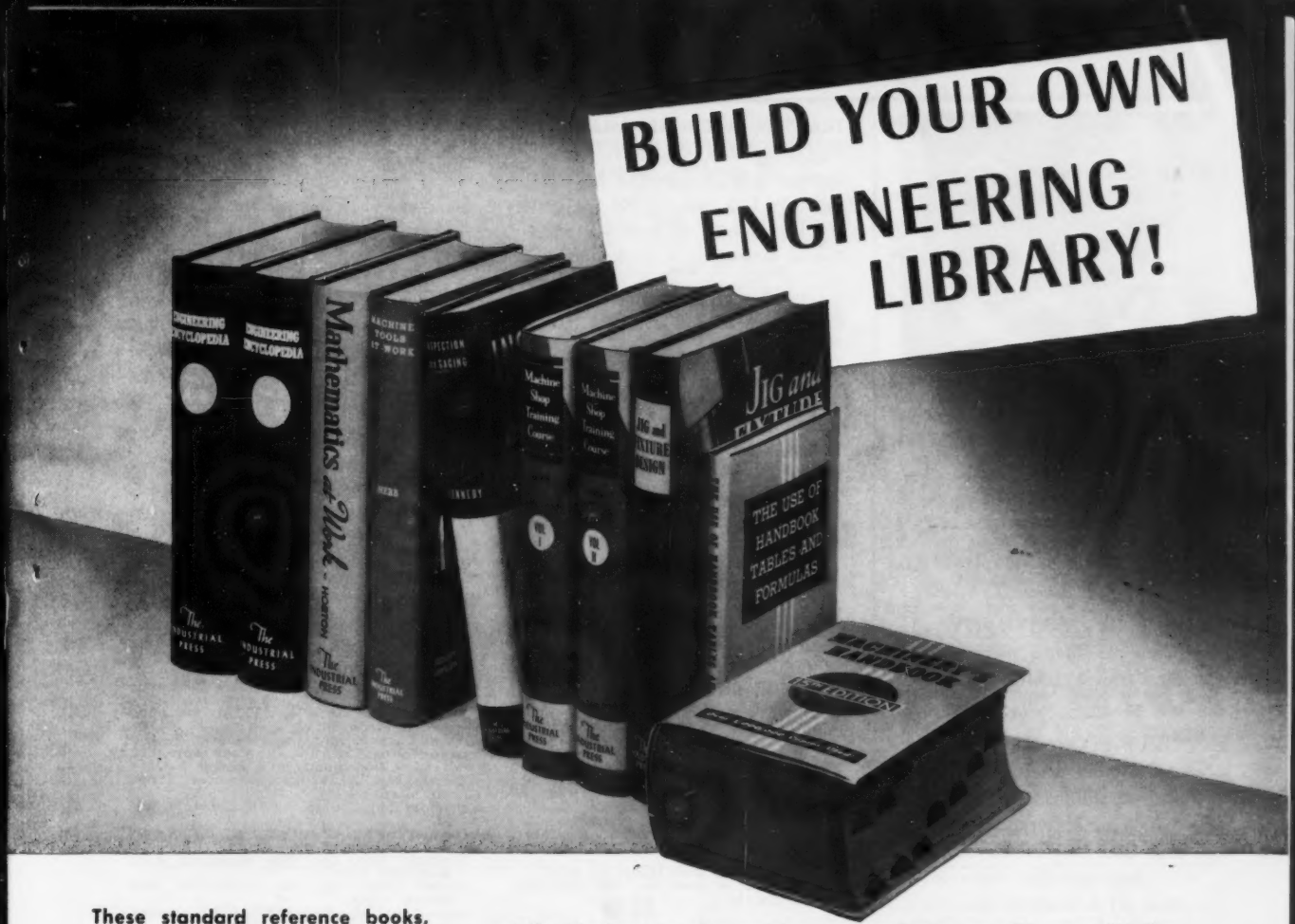

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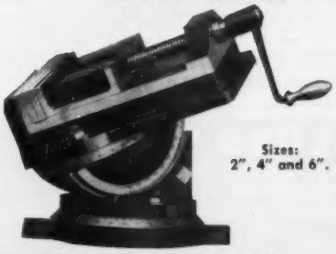

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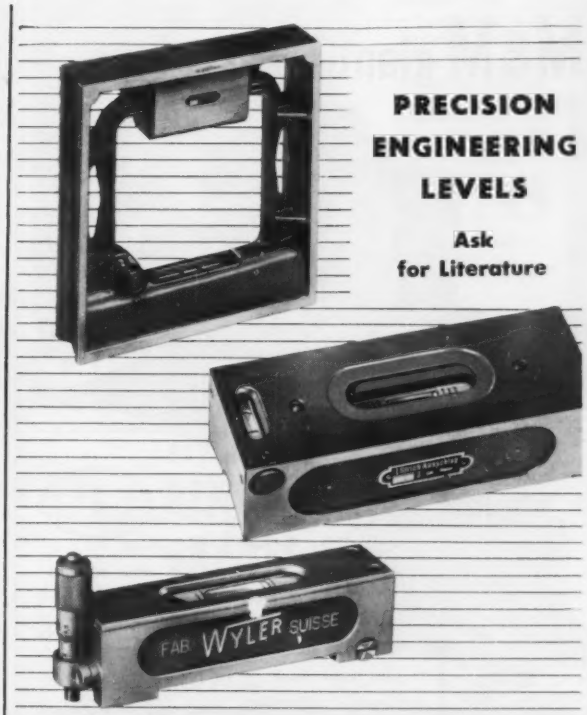

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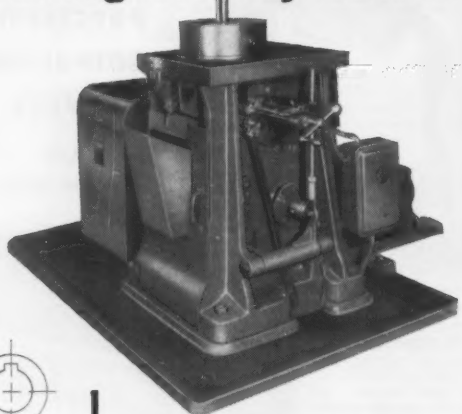

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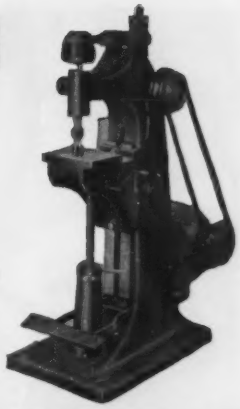

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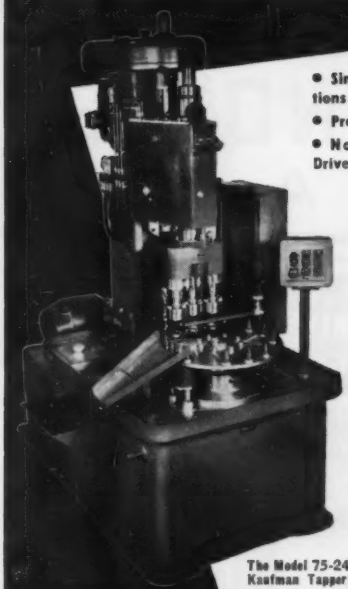

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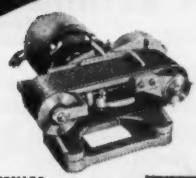

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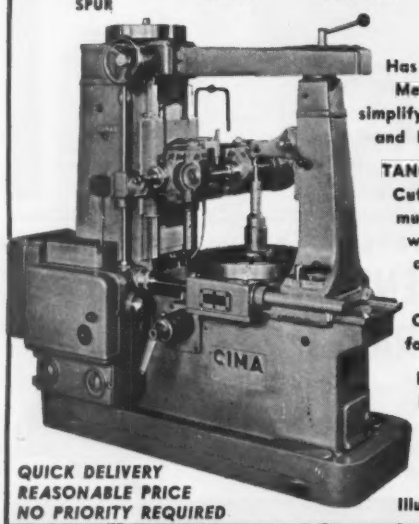

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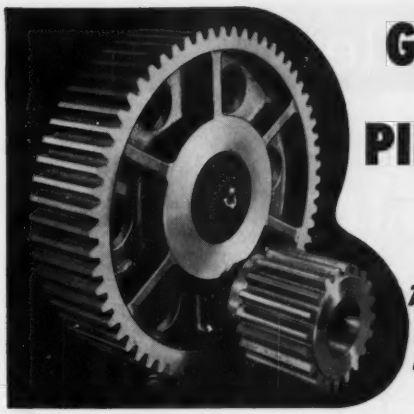

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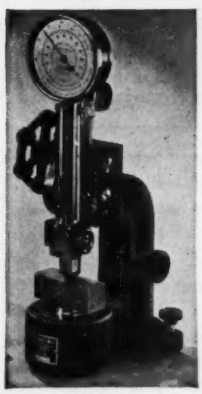

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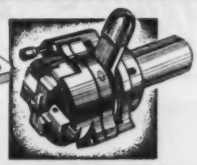

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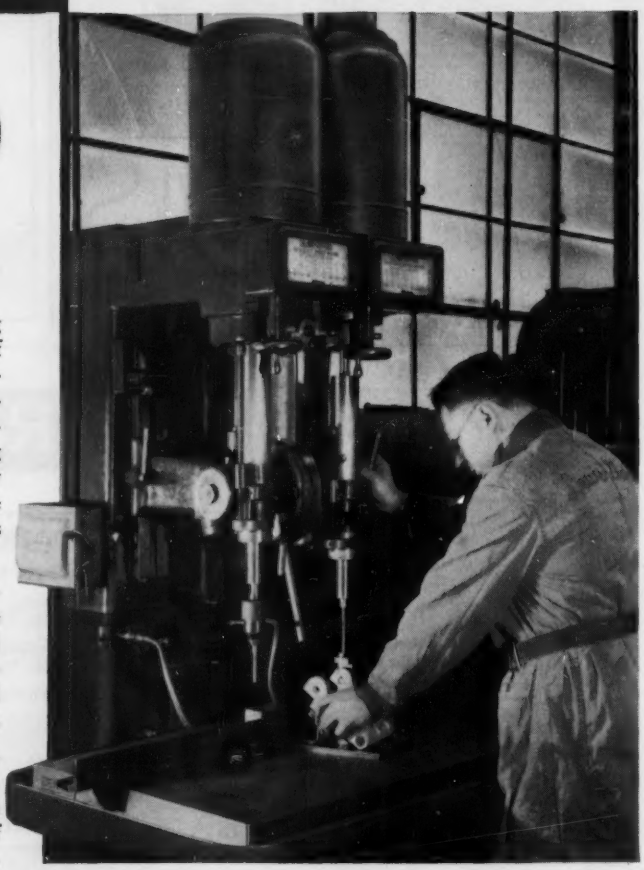

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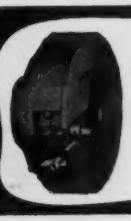

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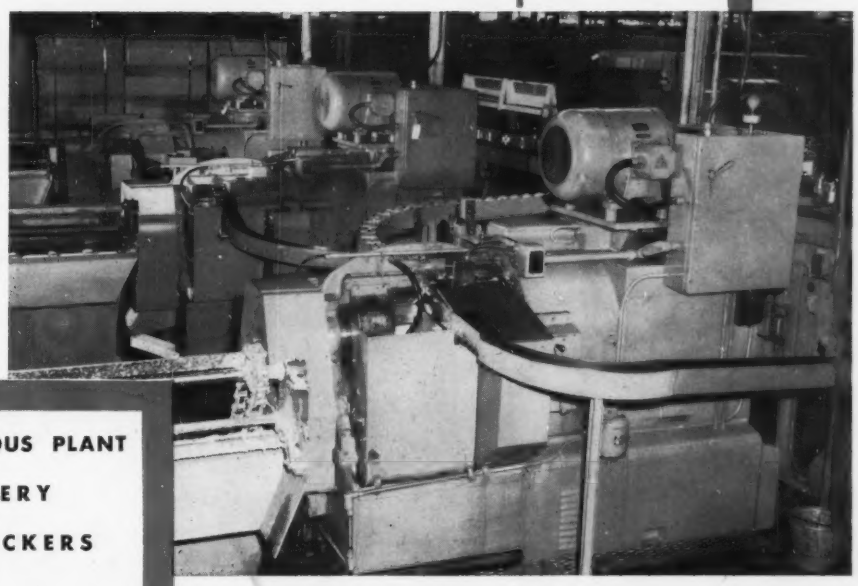
. . . IF IT'S A HIGH PRODUCTION PROBLEM . . .

ASK BAIRD ABOUT IT



ANOTHER WORLD-FAMOUS PLANT
INSTALLS BATTERY
OF BAIRD CHUCKERS

The photo above shows four of a battery of eight Baird 6-spindle automatic Chucking Machines performing the complete turning operations on aluminum alloy pistons . . . including automatic feed and discharge.

The Plant Manager says, "Previous methods of finish-turning required *four* separate operations. Now, the same results are attained in one operation . . . faster and with less chance of error." Cutting speed is 1332 to 1350 ft. per minute . . . feed per revolution .018 to .025. Actual cutting time at each station approximately 5 seconds . . . complete cycle 7.36 seconds.

Baird Chuckers are designed and built to insure positive, continuous, production . . . tooled for precision at low unit costs that give you a definite, competitive advantage.

As automation of large plants advances, Baird automatics can play a vitally important part in your production lines. And Baird engineers, highly experienced in special tooling techniques, offer you solutions for tough production problems. It will pay well to "ask Baird about it."

Write to Dept. M

THE BAIRD MACHINE COMPANY
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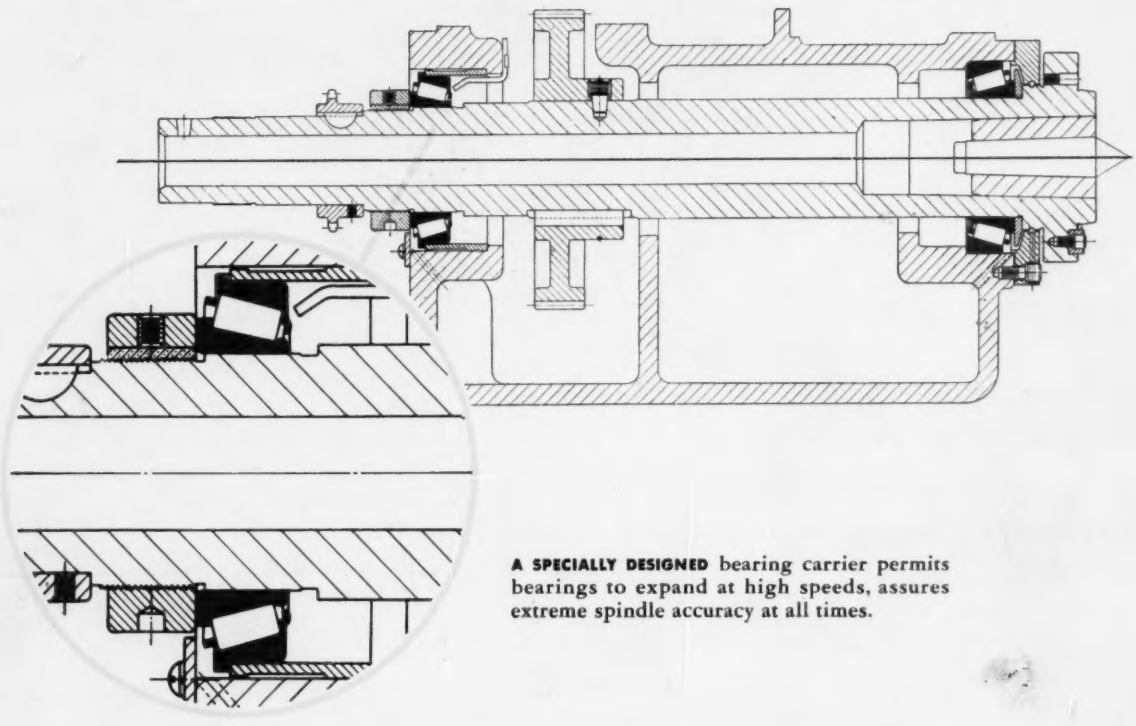
WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

How to maintain extreme spindle precision from low to very high speeds:

TIMKEN® bearings with semi-flexible mounting



A SPECIALLY DESIGNED bearing carrier permits bearings to expand at high speeds, assures extreme spindle accuracy at all times.

THE Timken Company has an ingenious solution to the problem of maintaining a high degree of spindle precision in machine tools. At high speeds, bearings expand. Normally this would cause the bearings in a precision mounting to tighten up and become excessively preloaded. But engineers at the Timken Company have developed a semi-flexible mounting. The rear spindle bearing is mounted in a special carrier. The carrier is designed to permit the rear bearing to expand radially while the entire spindle assembly expands longitudinally. As a result the desired bearing setting is maintained under all operating speeds. Extreme spindle accuracy is maintained at all times.

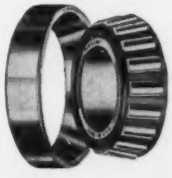
Timken® tapered roller bearings with these mountings have been applied to the spindles of many types of machine tools with great success. Of course not all machine tool spindles are required to operate at high speeds and over a variable range of speeds. The conventional Timken spindle mounting is entirely adequate for most machines.

Whatever your requirements, there are Timken tapered roller bearings to meet them. If not we'll find a new way, as we did when machine tool builders originally asked for precision bearings. And as we did when they asked for greater accuracy, which led to the famed Timken "O" and "OO" bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ◯ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⓡ AND THRUST →ⓣ← LOADS OR ANY COMBINATION →ⓡⓣ←